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The Automobile

Europe's High-Efficiency Motor

Part I

A Series Dealing with All Problems of Design for Racing or Touring Cars—Both Theory and Practice Considered —Forms Compared and Principles Elucidated

By S. Gerster*

MUCH of the recent progress in the design and construction of automobile motors is due to the rules of French road races and particularly to the 1913 French grand prix. In this race there were no restrictions of cylinder volume, but the fuel consumption had to be not higher than at the rate of 14.1 miles per gallon, with a minimum car weight of 1,763 pounds and a maximum of 2,425 pounds. The task was an unusually difficult one, for at the time exact data on motors of this type was lacking. Small motors of 250 to 300 cubic inches piston displacement filled the conditions to the best advantage.

In 1914 the race was run with a piston displacement limited to 4-5 liters, or 275 cubic inches, from which it was possible to obtain about 135 horsepower. In building the motors for this race advantage was taken of the experience gained during the 2 preceding years. It is a notable fact that not only was the piston displacement decreased for a given horsepower, but the fuel consumption was decreased in a very large proportion. Piston speeds were increased as much as possible in 1913, when it was found possible to attain a linear speed of 3,540 feet per minute; this figure was increased very slightly the following year. Rotary speed was carried up to 3,600 r.p.m. and the ratio of stroke to bore was 1.9 to 1.

In two-cycle motors piston velocity was limited by reason of the friction of the pistons in the cylinders, and to the inertia of the pistons when these latter were of the stepped or piston-pump type.

In four-cycle, poppet-valve motors piston speeds are generally limited by the sections of the gas passages through the valves. The inertia of the valve and of the pushrod enter into account and cause a certain lag in the closing of the valve. This brings about defective feeding and scavenging of the cylinders.

Later in this article I shall point out the progress and changes made in the earlier types of motors. For the present we are not concerned with *light* motors, but with motors that are efficient in relation to their displacement, and of motors with a low gasoline consumption.

Linear piston displacement is the basis of the design of any motor, but this is tributary to other factors, such as the inertia of the masses in movement,

* Editor's Note—*S. Gerster, the author of this series of articles written exclusively for* The Automobile, *is particularly well qualified to deal with all the problems of the small, high-speed, high-efficiency motors from which European engineers have obtained such wonderful results. After a technical training in the Swiss engineering schools and universities, Mr. Gerster entered first the steam then the gas engine department of one of the leading French engineering firms. For a number of years he has specialized in motor design, and as an independent engineer is responsible for the design of one of the most successful series of motors built by a firm manufacturing for the trade only. Mr. Gerster is a lecturer on motors at the French Army Aeronautic School.*

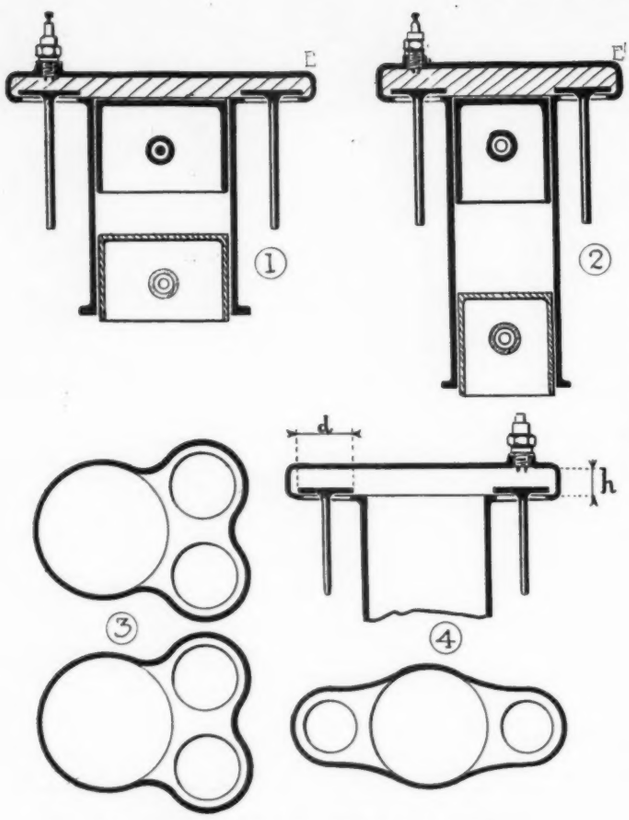


Fig. 1—Square motor with stroke and bore equal
Fig 2—Motor with stroke twice the bore, showing distance from spark plug to furthest point of combustion space greatly reduced
Fig. 3—Illustrating inconvenience of L-head motor when valves are large
Fig. 4—Showing proportion of combustion space depth to valve diameter—h may equal one-quarter d, in extreme cases

the section of the gas passages, the weight of the valves and pushrods, the shape of the combustion chamber, etc. If all these factors are in correct proportion, it is possible to obtain the piston velocity already mentioned, namely 3,540 feet per minute, or

$$Vp = 3{,}540 \text{ feet per minute.}$$

In the majority of touring car motors of the present day, piston velocity varies from 1,570 to 2,350 feet per minute. The higher value is that of the high-efficiency motors built by such firms as Hispano-Suiza and Vauxhall.

The number of revolutions of a motor is a function of the piston speed, of the stroke, and of the auxiliaries already mentioned. It may be stated that the r.p.m. of the motors under consideration is between 3,500 and 4,000, whereas the older types of car motors varied from 1,800 to 2,000 revolutions:.

The ratio of bore to stroke is, in general, as follows:

$$\frac{D}{C} = \frac{1}{1.8} \text{ to } \frac{1}{2}$$

when

$$D = \text{diameter of the piston}$$

and

$$C = \text{stroke of the motor.}$$

Formerly motors were built with a ratio of

$$\frac{D}{C} = \frac{1}{1}$$

as shown in Fig. 1.

With such an arrangement the combustion chamber was very flat and an appreciable length of time must elapse before the whole of the mixture is ignited from the spark plug B to the point *e*.

Fig. 2 shows a cylinder with a bore-stroke ratio of 1 to 2. It will be seen that the combustion chamber is much more compact, and in consequence the ignition of the mixture from the plug to the point E is much more rapid and the motor is capable of turning at a higher number of revolutions. It is necessary, in order to secure the highest efficiency, to obtain a combustion chamber as nearly approaching the spherical as possible.

Effect of Shape of Combustion Space

The form of the combustion chamber is of the greatest importance in a high-efficiency motor; unfortunately structural difficulties do not always allow the most advantageous form to be adopted. Fig. 3 shows the least advantageous arrangement if high efficiency is to be secured. The two valves are side by side, and if they are made sufficiently big for their work the cylinders become widely separated, the length of the motor is exaggerated and weight is increased. However, it is possible to build this type of motor with a fairly high coefficient of power efficiency.

A better arrangement is shown in Fig. 4, with valves on opposite sides. In order to diminish the area of the combustion chamber it is necessary to reduce the height *h* as much as possible. It can be made 1-4 of *d*. By using a single spark-plug, placed over the intake valve, it is possible to obtain an excellent efficiency. This type of motor is well represented by the Hispano-Suiza. By the use of two plugs per cylinder it is possible to obtain an increase of 3 per cent. in the power.

A better arrangement is that of the Mercedes aviation motors with two valves per cylinder, as shown in Fig. 5, where the efficiency is again higher.

In order to get a better result from the combustion chamber, it has been fitted with four valves, two for the intake and two for the exhaust. In this way a more advantageous form of combustion chamber is obtained than with two valves only. Another advantage is the decrease in the weight of the valves. By the use of two intake valves for a given diameter of gas passage, it is possible to obtain a lower weight than with a single valve. By this means only it is possible to increase the r.p.m. of the motor without being handicapped by the inertia of the valves and the push rods. Fig. 6 shows an arrangement with four valves from which it is possible to obtain a very high efficiency indeed. The combustion chamber is the most compact possible with the T-head type of motor.

All Racing Motors Have Four Valves

The arrangement shown in Fig. 7 is more commonly employed and is that which gives the best results. The two intake and the two exhaust valves are on opposite sides and

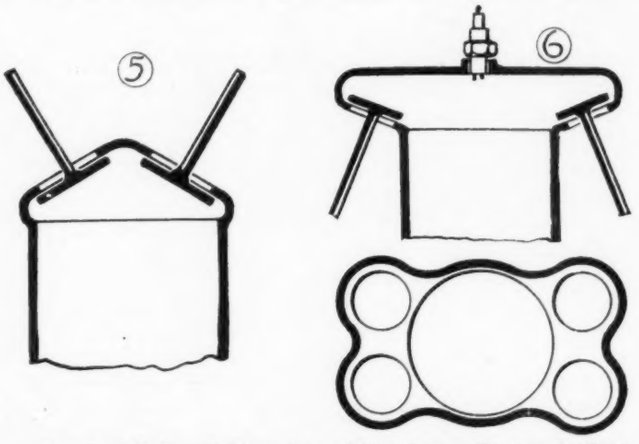


Fig. 5—Cylinder of Mercedes aviation type with two inclined overhead valves
Fig. 6—Best possible form of T head with four valves

in the same plane. They are operated either by a single camshaft with rocker arms or by two camshafts, one above each row of valves. With this arrangement the maximum efficiency has been obtained.

The latest racing motors built by Mercedes, Schneider, Opel, Peugeot, Delage and Alda were designed on this principle. The Alcyon company has sought to get better results by building a motor with the combustion chamber as shown in Fig. 8, AA being the longitudinal axis of the motor. The mechanism for operating these valves became too complicated, the weight of the moving parts became too great, vibrations were set up in these parts and the motor speed was limited.

In designing a new type of motor, the use to which it is to be put should be kept clearly in view—whether it is for a racing car, an aeroplane, a dirigible balloon, or for a touring car intended to have a long life. If it is for a racing car there is every incentive to get the piston speed V*p* as high as possible. Thus:

In aviation motors having the propeller mounted on the crankshaft, the designer is generally limited by the number of revolutions of the propeller and in consequence the piston speed is low, namely:

V*p* = 18 to 20 meters (59 to 65 feet) per second.

For high efficiency touring car motors it is possible to get the following:

V*p* = 14 to 16 meters (46 to 52 feet) per second.

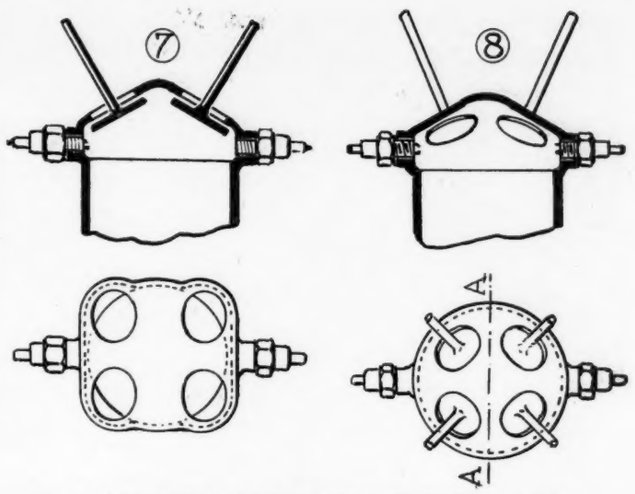


Fig. 7—Most popular design of four-valve overhead motor
Fig. 8—Four valves arranged so as to approximate still closer to the hemispherical form. This proved unsuccessful by reason of the weight of valve-operating parts

We may next proceed to consider the effect of compression and of the speed of the gas through the ports and manifolds.

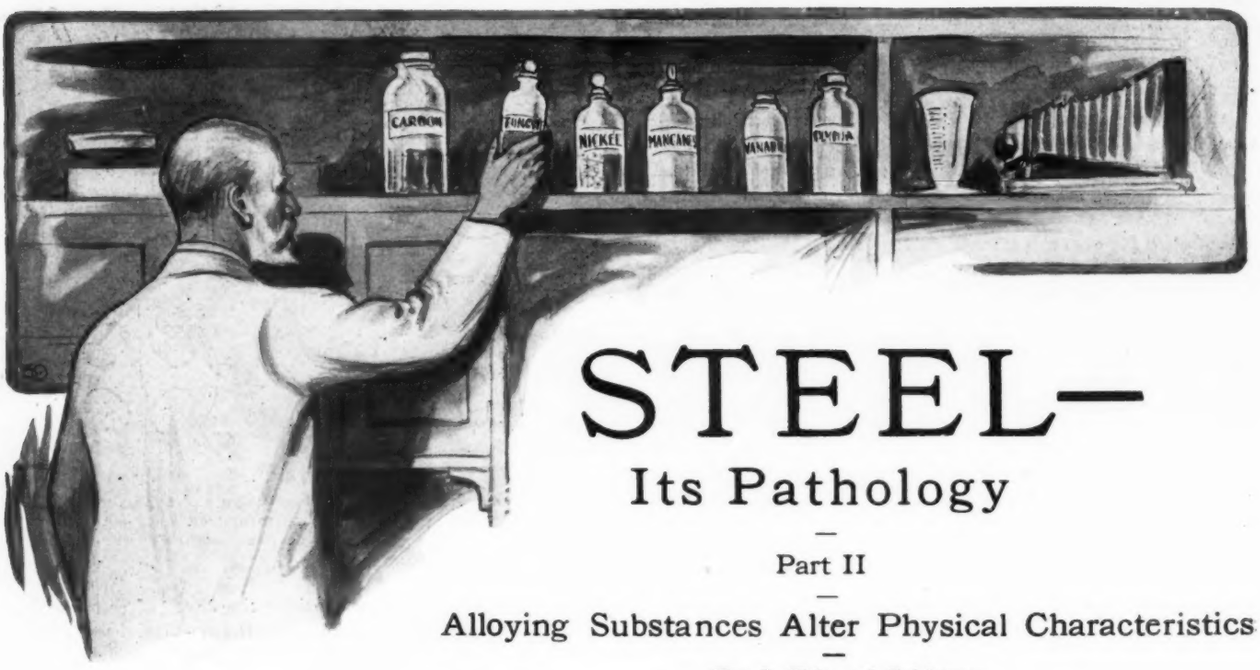
(To be continued)

Testing Cadillac Eights on 72 Motor Stands with Full Dynamometer Equipment

DETROIT, MICH., April 12—The motor testing department of the Cadillac Motor Car Co. is good proof of the fact that the concern is making eights and making them fast. The room has seventy-two engine stands with electric dynamometers and all apparatus ready for running the newly assembled motor. The test is really for "running-in" purposes, and each engine undergoes four different runs before it is ready to go into a chassis. The total of these runs is 5 hours, and they are as follows: First—At 450 r.p.m. developing 3 horsepower for 1-2 hour; second—at 600 r.p.m., 6 horsepower for 1-2 hour; third—developing 7.5 horsepower for 1 hour; and fourth—at 1,000 to 1,100 r.p.m. developing 10 horsepower continuously for a period of 3 hours.

After this preliminary testing, which takes in a complete adjustment of the engine, it goes to the chassis department, and, after being connected up, there is an indoor chassis test.

The power produced by these engines drives the individual electric generators, and is used to assist in supplying the Cadillac plants, the electric energy thus obtained being added to that received from outside sources, after having been put through a motor-generator set which takes care of any variation in the output of the testing department. The average current obtained in this way is 240 amperes per hour at 250 volts.



STEEL—

Its Pathology

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Part II

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Alloying Substances Alter Physical Characteristics

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By J. Edward Schipper

THERE are two main steps in the preparation of an alloy steel: first, the writing of the formula which consists in selecting the required alloying substances in the proper quantities, and second, the heat treatment.

To one only slightly familiar with the principles of metallurgy the marvelous changes that can be made in the qualities of the steel are well known, but before the temperature can be used to good effect the ingredients must be correct. In other words, the prescription accurately written. On the other hand, before the best effects of the alloy are gained the proper heat treatment must have been applied. Thus the two work hand in hand. The doctor of steel must first write his prescription and then place his patient in the climate which will be the most beneficial for the particular ends which he desires to gain.

DOSAGE

Element	Per Cent.
Carbon	.05 to 1.5
Manganese	.35 to 12.0
Nickel	1.00 to 36.0
Tungsten	.40 to 24.0
Chromium	.50 to 2.0
Vanadium	.12 to 6.0
Silicon	0.00 to .4
Titanium	0.00 to .1
Aluminum	0.00 to .02
Molybdenum	0.00 to 15.00

Before touching upon the effects of temperature we will first consider the alloys most employed in their particular uses. These are the medicines, the tonics, the diets and the health-giving and strength-promoting ingredients which enter into the makeup of the final product. As pointed out in Part I there are five primary qualities which are desired for structural work: Hardness, toughness, malleability and the ability for resisting shock and heat.

Nickel, being probably the most valuable of our alloys, is logically the first to be considered. Of all the alloy steels used in automobile work nickel steel is probably most frequently employed. It is valuable because it possesses the properties of high elastic limit, hardness and ductility. In other words, it can be put to severe stresses before becoming distorted, or, as it is technically termed, before it assumes a permanent set—elastic limit. It is sufficiently hard to withstand ordinary indenting stresses—hardness, and it is malleable enough so that if desired it can be drawn or forged without rupturing or harming the material—ductility.

Nickel is a sinew builder in steel. It increases the strength of the metal in many ways. Thus it is like the food of an athlete designed to build up the muscle. It is not the greatest creator of endurance, but inasmuch as endurance depends greatly on strength, it does render the steel somewhat greater in its resistance to repeated stresses. For example: In a competitive test between two steel shafts, one of .40 per cent. carbon and the other containing 3.25 per cent. nickel, the latter endured nearly six times the number of revolutions that were endured by the shaft of carbon steel. Krupp steel, which is used extensively for armor plate and which has played such a large part in the great European war, is a steel containing 3.25 per cent. nickel and in addition another great strength builder, chromium, to be dwelt upon later.

Nickel the Muscle Builder

Another way in which the nickel steel compares with the muscle-building food of the athlete is in the litheness which it promotes. The litheness of a man may be compared to the ability to be forged in a steel. Nickel steel forges readily and when the carbon is low it can easily be worked cold. Here is seen the trait of carbon which, when high, makes for hardness and, when low, for softness. Thus, low carbon nickel steel can be bent while cold without losing any of its strength; whereas, on the other hand, high-carbon nickel steel is very hard.

Nickel is generally added in the percentage of 3.5, and in nickel steel carbon ranges from .10 to .75 per cent. Tensile strength, which may be called toughness, or the ability to resist a force which tends to pull the metal apart, is the great criterion of steel. Nickel steel has a 40 per cent. greater tensile strength than a simple steel of the same carbon content. Or, to put it in another way, the elastic limit of nickel steel is from 10 to 20 per cent. greater than a carbon steel of the same tensile strength.

Nickel does not produce its full effect without the help of the medicine, manganese, the purgative. This must be in the

correct proportion to neutralize the harmful sulphur and oxygen or the value of the nickel will be lost.

The use of nickel is not new, having been known since the earliest times of which we have record. It was employed by the old Chinese in the form of an alloy called pakfong and outside of its use as a structural steel alloy it has many other uses. One nickel steel known as Invar containing 35.7 per cent. nickel has such a small coefficient of thermal expansion that it is practically negligible.

Although in catalogs the use of nickel steel is mentioned for a wide variety of parts throughout the car, it is not true that only one kind of nickel steel can be used for all purposes. There are various kinds and qualities of nickel steel, the chief difference being that in the results secured by the heat treated processes. For general use the 3.5 per cent. nickel is that most in demand and one authority gives as a very useful composition for drop stampings or forgings of such parts as steering levers, connecting-rods, etc., the following:

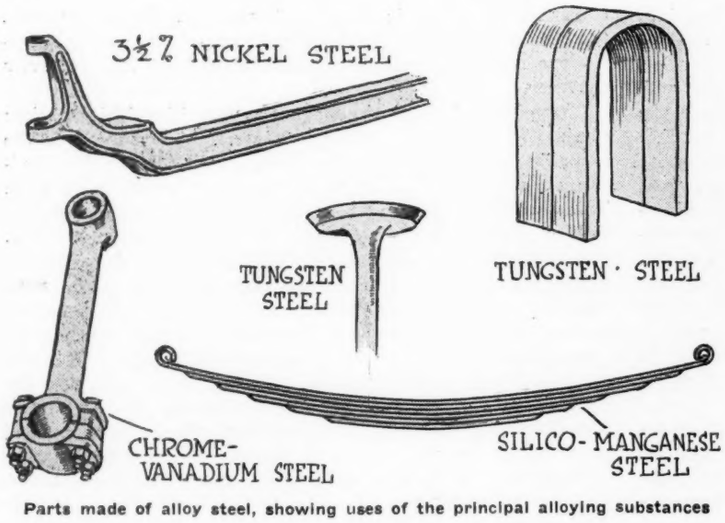
Carbon	.30 to .35	per cent.
Silicon	.15 to .175	" "
Sulphur not exceeding	.03	" "
Phosphorus	.03	" "
Manganese	.60 to .75	" "
Nickel	3.00 to 3.50	" "

After being heat-treated a steel of the above specifications will have a tensile strength of close to 50 tons per square inch. A 1-inch bar could carry suspended twenty-five large touring cars, a simple steel having carbon alone in the percentage of .40 would carry fifteen cars only. The elastic limit is 37 tons per square inch. Before stretching beyond its first length a weight equal to 74,000 pounds could be lifted as compared to 48,000 pounds for steel without the nickel.

Thus, nickel is a toughener. It increases the elastic limit in great proportion to the ultimate strength of the material. At the same time, it produces a steel that acts well under repeated stresses. Furthermore, it can be made with great uniformity and the results obtained from a stated prescription can be calculated upon in advance with the certainty that the ultimate results will justify the calculation.

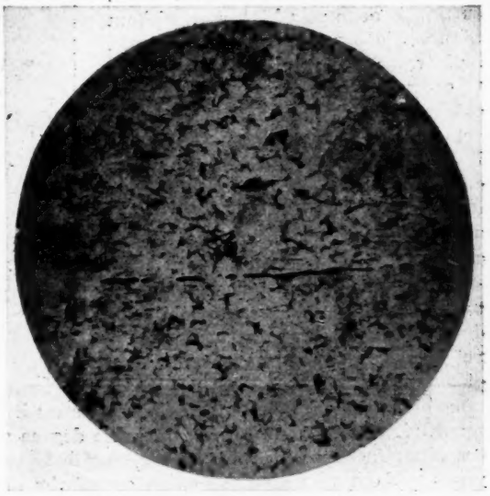
The probable reason for the strength of nickel steel and its toughness can be traced back to the molecular structure. Nickel steel has very minute grains, the molecules being small and uniform, furnishing no lines of weakness such as are found in structures where large grains exist. It is comparable to sewing together two pieces of cloth. If only a few stitches are taken to effect the joining of the cloth, it will be much weaker than were they sewed together with fine stitching. There are no lines of weakness and consequently there is little tendency for a crack to spread through a large extent of the metal.

Tungsten does for steel what hard work and training do for the athlete. It hardens the metal and renders it impervious to wear. In the athlete, if he were training for a football contest and accomplished for himself what tungsten does for steel he would be able to withstand great punish-

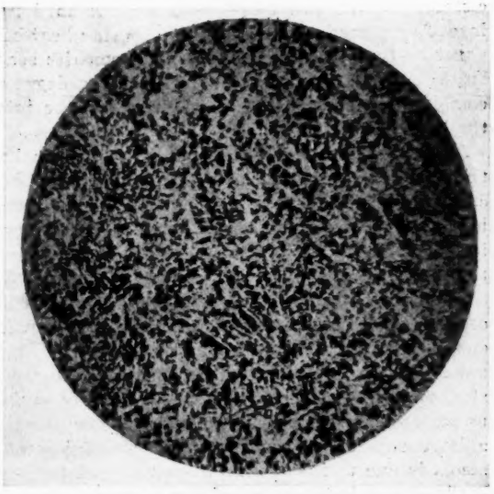


Parts made of alloy steel, showing uses of the principal alloying substances

Micro-photograph of wrought iron, showing the coarse grains when magnified 500 diameters. These grains are ferrite, a form of practically pure iron.—W. Campbell.

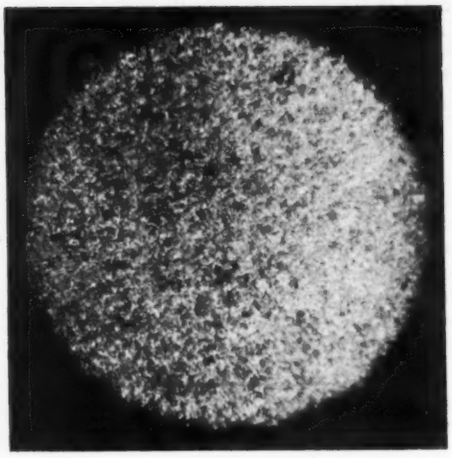


Low carbon steel magnified 50 diameters. Note the finer grain as compared with the wrought iron above, showing basic difference between iron and steel. The streaks through the center are slag, rolled into sheets.—W. Campbell.



Refined steel casting. The three micrographs shown above are definite steps in the manufacture of unalloyed steels. It is interesting to compare them with the alloy steels shown on the following pages.—W. Campbell.

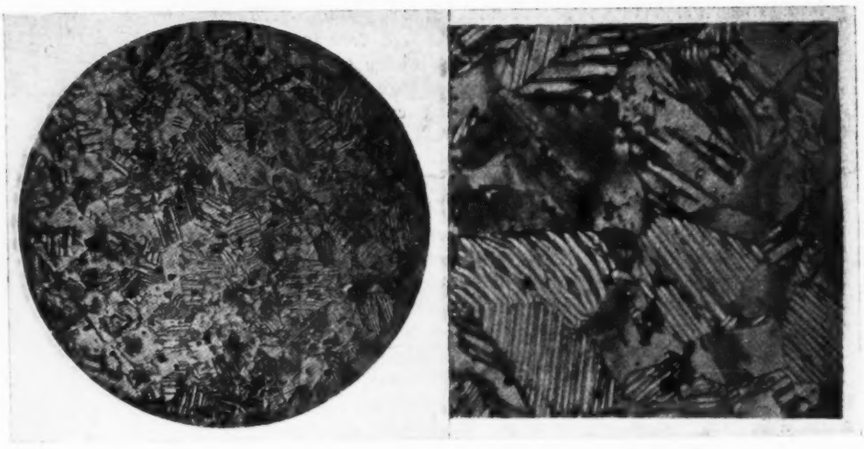
ment without becoming bruised. Tungsten steel has for its main recommendation the fact that it can go through enormous stresses and under trying conditions of high temperature without losing its quality of hardness. Primarily tungsten is a hardening element, a resister of heat and a retainer of magnetism. These three qualifications have made this one of our most important alloying substances.



Top—Chrome nickel steel in its refined condition, showing the closely interwoven molecular structure which gives the steel the remarkable tensile strength and high elastic limit.—United Steel Co.

Lower left—Hadfield's manganese steel before refining, showing the coarse structure of the metal. This shows the grains magnified 100 times.—R. A. Hadfield

Lower right—The same steel magnified 600 diameters, showing the lamellar construction of the grains which go to make up the mixture.—R. A. Hadfield



Tungsten Promotes Hardness

By incorporating simultaneously carbon and tungsten it is possible to obtain a much harder steel than with carbon alone and at the same time the dangers of increasing the brittleness to a dangerous extent are eliminated. It is used in combination with chromium for high-speed steels with which cutting is done at a high rate without the tools losing their edge through the high temperatures created. Naturally, to endure the stresses and shocks of cutting through steel the metal which acts as the cutter must be hard and it must have the necessary shock-enduring qualities. The hardness is imparted by the tungsten. The shock-absorbing qualities are imparted by chromium.

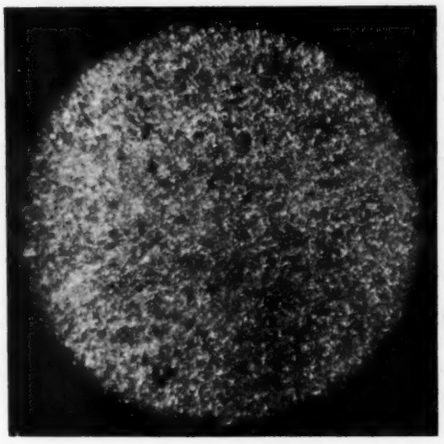
One of the greatest uses to which tungsten is put in the automobile industry is in the manufacture of magnet steel for the permanent magnets of magnetos. When added in proportions of from 5 to 8 per cent. to magnet steel it increases the retentivity of magnets to a remarkable degree and is one of the great factors which allow magnetos to be used for many years without requiring a recharging of the magnets. For poppet valves it is also of great service because it renders the steel hard and therefore removes the danger of pitting always present in cast iron which is frequently used because the resulting structure of the tungsten steel is so finely and closely grained and takes such a glass-hard finish that no inroads are made upon its surface by the heat of the exhaust gases or the pounding of the valve upon its seat. Tungsten raises the melting point of steel to such a degree that certain combinations have been known to resist the intense heat of the blowpipe.

Tungsten assists the carbon in producing hardness and, therefore, in tungsten steel where the tungsten is high the carbon may be low. A less amount of carbon will produce hardness in the presence of tungsten and therefore by its influence on the formation of the grains of different combinations of iron and carbon it renders the metal hard. Tungsten steels have been put on the market in which the percentage of tungsten formed nearly 1-4 or 25 per cent. of the entire mixture, but the usual composition includes only between 4 and 12 per cent. What quality in tungsten makes steel retain magnetism cannot be definitely said as it carries us back to the unexplained reasons for magnetism. The probable reason for the raising of the melting point of tungsten steels is due to its own high melting point.

Chromium is the bone builder of steel. It is like the phosphates given by the doctor to build human bone. It strengthens its structural framework and gives it the ability to resist fatigue. In fact, many metallurgists insist that it is the chromium which permits the vanadium to exert its well-known property of making the steel able to resist continuous fatiguing stresses. Chrome-vanadium steels are known for this ability to resist stresses which are oft repeated, but exactly where the action of the chromium ceases and that of the vanadium commences is a much-mooted point. When a human being has a large, bony frame he is able to carry a much greater weight than a man of lighter frame with the same proportion of muscle and tissue. Chromium builds up this bony structure of the steel and overcomes its tendency to become fatigued. When steels become tired the term crystallization is often given to the intermolecular disintegration or separation which is stated to take place. In other words, the structure of the steel breaks down, eliminating the continuous chain of strength which should bind the molecules together.

Chromium takes the one weakness out of hard high-carbon steels. It is a great hardener in itself and yet, it has the valuable quality of combining when in the hardened or suddenly cooled state intense hardness with a high elastic limit. This combination tends to render the steel proof against sudden shocks—a much-desired condition in a hard steel. Since the steel that chromium is used with is hard, one would expect to find the carbon content high and this is the case. The S. A. E. chromium steels have from .95 to 1.20 per cent. carbon, twice as high as in carbon steel, and from 1 to 1.2 per cent. chromium. The hardness is proportional. The manganese in these steels runs from .20 to .45 per cent. and the phosphorus and sulphur not over .03 each. Owing to the property of the chrome steel to resist violent shocks, it is used practically universally for armor plate in conjunction with nickel. Armor plate must be tough and hard, hence nickel and chromium.

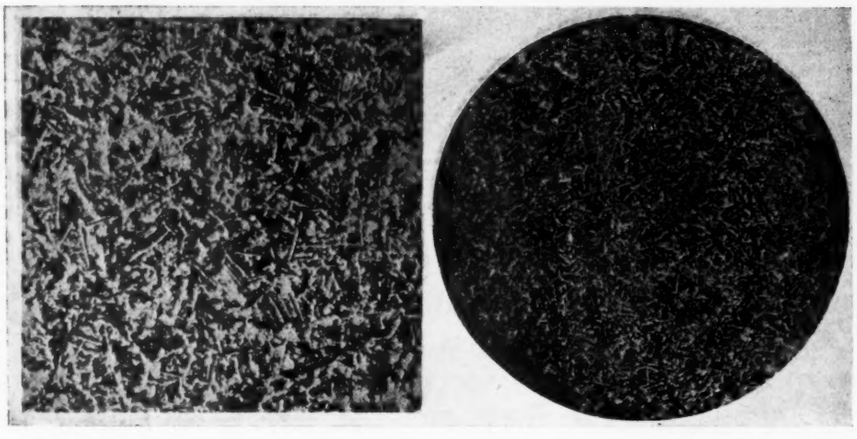
Chromium enters into what is known as high-speed steel in



Top right—Chrome vanadium steel in its refined condition, showing the closely interwoven grains which are due to the holding of carbon in the form of a solid solution. Here the grains are minute and the resulting structure is of great strength. —United Steel Co.

Lower left—Refined Hadfield steel which contains 12 per cent. manganese, showing the structure which is so valuable in securing the necessary hardness. This is magnified 600 diameters.—R. H. Hadfield

Lower right—Hadfield steel in a refined condition magnified 100 diameters. On this scale this steel can be directly compared with chrome-vanadium and nickel steel, also shown on these pages.—R. H. Hadfield



combination with tungsten. This steel is known as high-speed steel on account of its property of remaining hard while red hot at a temperature of 600 degrees Centigrade, allowing cutting of metal to progress at high speeds. Chromium is a factor in the hardness of this steel.

One of the draw-backs of chromium is that it lessens the weldability of the metal, and hence when the doctor of steels considers his prescription he will not put chromium in a steel which is to be welded. Chromium, like the other useful alloys, has an influence on the size of the grain, helping to render the intermolecular structure solid by reducing the size of the independent grains which go to make it up. All steel is crystalline and, naturally, the smaller the crystal the stronger the steel, generally speaking.

Vanadium—The Steel Tonic

Doctors of medicine give their patients tonics to increase their vitality when they are in an anemic condition. The metallurgist, the doctor of steel, gives vanadium for the same purpose. With the single exception of carbon there is nothing which has such a powerful effect upon steel according to most authorities as vanadium, for it is only necessary to add between .16 and .25 per cent. to give steel the property of resisting to an enormous degree the effects of fatiguing stresses. Incidentally, it acts as a great purifier in ridding the steel of oxygen and perhaps nitrogen. It is said to increase the uniformity of the structure of the metal and thus also to promote its strength. In automobile work it is used for springs, axles, gears, etc., which are subject to repeated and continued shock and it is generally incorporated in connection with either chromium or nickel.

Vanadium steels are not generally used where extreme hardness is required and hence we find the carbon content as a rule fairly low, ranging from .10 to .55 per cent., according to the S. A. E. specifications for nickel-chrome-vanadium steel. In these steels the vanadium percentage is at least 1.2 per cent. Nickel, the strengthener, is used in 1 to 2 per cent.; chromium, the frame builder, .30 to 1 per cent. Thus we have a steel which the specifications alone will tell those who have followed the qualifications of each ingredient that here is a steel which, while not exceptionally hard, has great endurance due to the vanadium, has great strength due to the nickel and has a healthy frame of chromium enabling the qualities inherent in the other ingredients to make themselves felt.

It would be impractical to put the muscles of a giant on the framework of a pigmy because the bones would be broken under the stresses of the muscles. Likewise in steel it would be useless to build up the strength of the molecules unless the frame work which held the structure together were sufficiently strong.

In steels containing .20 carbon and from 2 to 12 per cent. nickel, the tensile strength and elastic limit are both admittedly increased by the addition of small percentages of vanadium. An overdose of this great vitalizer is as bad, however, as overdoses of tonic of any kind would be to the human system, and many authorities are agreed that in no case should the percentage of vanadium exceed 1 per cent., the best results being obtained between .7 and 1. A 12 per cent. nickel vanadium steel has given up to 200,000 pounds per square inch tensile strength. This would indicate that the vanadium not only increases the static strength of the material but also its resistance to fatigue. It is therefore a valuable addition to the list of ingredients useful to the metallurgist.

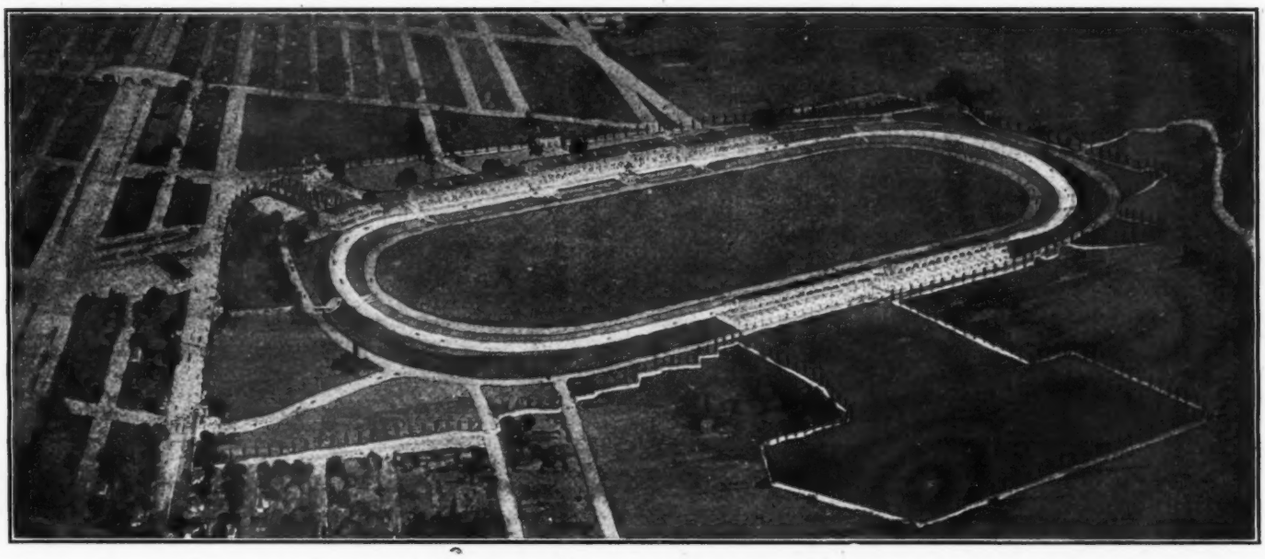
The alloys reviewed thus far are what may be termed the foundation of modern steel practice. They are the principal ingredients from which the doctor of steel writes his prescription to meet the needs of the particular class of work in view. There are others, however, which make up the secondary list that can be drawn upon in case special results are desired. Aluminum, for instance, is rarely thought of by the layman as a steel alloy and yet it forms an excellent deoxidizing agent. In other words, in the language of the steel manufacturer, it kills the metal, removing all the free oxygen. In contra-distinction to manganese, which has been pointed out is the deoxidizing agent most frequently used, it adds no hardness to the metal, being in this respect similar to silicon, arsenic and copper. It is said that .1 per cent. is ample to obtain perfect solidity of a steel by removing the oxygen, when the aluminum is added in metallic form.

In a word, it combines the functions of silicon and manganese and while these alloys are so cheap and aluminum so expensive there is hardly any use in employing the latter for work that can be just as well done by the cheaper products.

Silicon, which has been briefly mentioned, is a hardener of steel. In automobile work the most prominent use for this alloy is in silico-manganese steel springs. Here we

(*Continued on page* 695)

Big Backers for New York Speedway



Architects' plan showing how the Sheepshead Bay track will look as a 2-mile automobile speedway and arena for various other sports

Many Millionaires Among Stockholders of Corporation To Build 2-Mile Speedway at Sheepshead Bay—Design to Permit Speeds Up to 140 M.P.H.

NEW YORK CITY, April 13—A 2-mile automobile speedway 8 miles from City Hall, is at last to become a reality. The Sheepshead Bay Speedway Corp. has been duly incorporated with $2,500,000 capital, made up of $1,000,000 of 7 per cent. cumulative preferred and $1,500,000 common stock. The project is backed by the wealthiest interests in New York, who have come forward and subscribed $1,000,000 which will be paid into the treasury as the work of developing the speedway progresses.

432 Acres Secured

Sheepshead Bay race track, of world-wide reputation from the days of horse racing, has been secured, the track where the famous Futurity and Suburban stakes were the annual classics in horsedom. The location of the 432-acre property is one of the best in the vicinity of Greater New York, the track being situated on Long Island, within a few minutes of the well-known Brighton Beach track, famous for its 24-hour automobile races, and within sight of the ocean. It is within 35 minutes of Broadway, 20 minutes from Brooklyn and 10 minutes from Coney Island.

Two 500-Mile Races—Other Events

Beginning this fall, according to present plans, two feature races will be held on the speedway each season, one in early spring and the other about the middle of the autumn, both events being 500-mile contests with cash prizes of $50,000 or over for each. A 24-hour mid-summer race is also planned as well as a series of matinee events for stock cars.

The track itself will be a 2-mile oval of brick construction with scientifically banked curves. The width will be slightly greater than that of the Indianapolis Motor Speedway and the banking will be more of the saucer type used so successfully on the Brooklands track in England.

Two grandstands with boxes are planned to afford accommodation for 200,000 spectators, while within the track there will be parking space for 20,000 automobiles.

Track Is Very Accessible

In addition to automobile racing it is planned to stage other sporting events in the great enclosure. Present plans contemplate the promotion of international polo matches, aviation events, football, baseball and athletic games as well as military tournaments.

Facilities for reaching the track are excellent. Ocean avenue, one of the broadest of Brooklyn's boulevards, extends from Prospect Park direct to the main entrance, thus giving a boulevard approach with a driveway 100 feet wide for all automobilists. The Long Island railway from New York leads to within a block or so of the entrance to the projected speedway and within two blocks is the Brooklyn Rapid Transit system which connects with New York elevated and subway systems, making it possible to get there by the subway, by elevated, by steam trains, by automobile and lastly by boat from Coney Island, 10 minutes from the entrance.

Men of Means Behind Project

As an indication that this time New York is really to have an automobile speedway, the list of stockholders suffices to dispel all doubt, including as it does such well known names as:

Percy R. Pyne, 2nd; Harris M. Kilborn, Charles E. Danforth of Van Emburgh and Atterbury; Charles S. Sabin, president Guarantee Trust Co.; George F. Baker, Jr., vice-president First National Bank; Frank Bailey, vice-president Title Guarantee & Trust Co.; William Hull Wickham, of McKesson & Robbins; Kenneth Cowan; John J. Haynes; Mrs.

J. W. Gates; Anderson T. Herd; John J. Mitchell, president Illinois Trust & Savings Bank; Stanley Field, son of Marshall Field; A. J. Farwell, vice-president J. V. Farwell Co.; John M. Scott, of Carson, Pirie, Scott & Co.; A. A. Sprague, 2nd, of Sprague, Warner & Co.; Watson F. Blair, director Corn Exchange Bank; W. R. Linn, Southside Electric R. R. Co.; J. M. Cudahy, Cudahy Packing Co.; George A. Thorne, of Montgomery, Ward & Co.; James Deering, International Harvester Co.; John Stuart, Quaker Oats Co.; Chauncey B. Keep, Merchants Loan & Trust Co.; James A. Patten; Frank G. Logan, of Logan & Bryan; F. R. McLennan, director Continental & Commercial National Bank; Edward C. Carter; G. C. Nimmons; Fred F. Norcross; George R. Fearing, Jr.; N. F. C. Kachelmacher.

The Automobile Industry Represented

Among the prominent stockholders directly affiliated with the motor car industry are: Carl G. Fisher, president of the Prest-O-Lite Co.; A. C. Newby, National Motor Vehicle Co.; Hugh Chalmers, president Chalmers Motor Co.; H. M. Swetland, president Class Journal Co.; David Beecroft, directing editor of THE AUTOMOBILE, *Motor World, Motor Age* and *Motor Print;* Fred J. Wagner; Ralph DePalma; J. C. Nichols, president General Automobile Supply Co.; I. M. Uppercu, president Detroit-Cadillac Motor Car Co., of New York; S. S. Toback, president A. Elliott Ranney Co.; Charles E. Reiss; A. J. Kaufman, president Peugeot Auto Import Co.; William Parkinson, president Stutz Motor Car Co.; William A. Allen, president Allen Tire Cover Co.; William C. Poertner, president Poertner Motor Car Co.; Nathan Lazarnick; John C. Wetmore.

To Make Car Racing King Sport

With this galaxy of financial talent the aim of the movement is to make automobile racing the king sport of America, and through the motor enterprise and the club that will be connected with the speedway to get the millionaires purchasing racing creations and ordering special machines so that the sport will take as high a place in the land as horse racing did when at its zenith.

Organization Work Progressing

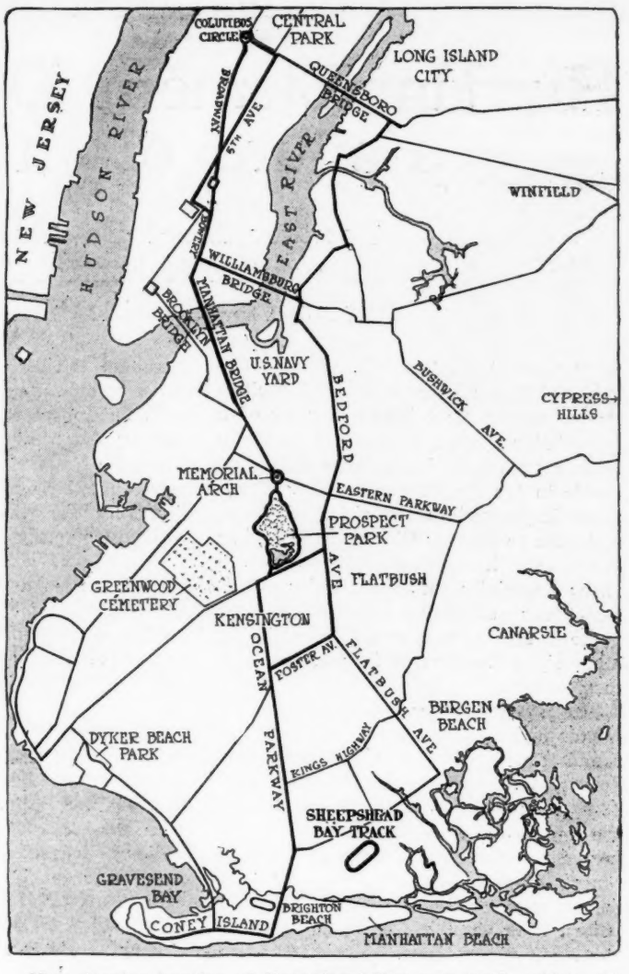
Elwood Thompson, graduate manager of the Yale Bowl, will resign to become manager of the Sheepshead Bay speedway and, as announced in THE AUTOMOBILE for April 1, B. H. Miller, who built the Indianapolis speedway, has been secured to superintend the construction of the track at Sheepshead Bay. Mr. Miller is now in the East attending to the preliminary details of organization work in this connection.

Anderson T. Herd, one of the first to be associated with James C. Nichols, who may be credited with being the pioneer in the enterprise, was the real estate broker who handled the transaction of purchasing the 432-acre Sheepshead Bay property from the Coney Island Jockey Club.

All the proceedings in regard to title and organization of the Sheepshead Bay Speedway Corp. have been passed upon and executed under the direction and supervision of Sherman & Sterling, Spier & Bartlett, Bowers & Sands and G. H. Previllier. The corporation has opened offices in the Whitehall Bldg., New York City.

Plenty of $50,000 Purses

With New York putting up $50,000 for each of two races, Indianapolis and Chicago each with another $50,000, and Sioux City with a fourth $50,000, or thereabouts, there is a possibility of a winning car in all four events cleaning up over $100,000 in a single season. These purses are the greatest ever offered in the sporting world and should be an inducement not only to our American factories to build special cars but also to our wealthy sportsmen to purchase machines to race on a complete circuit of the speedways.



Map showing location of Sheepshead Bay race track, which will be New York's great 2-mile automobile speedway, in relation to New York City, and also showing Brighton Beach and the various roads offering automobile approaches to the track

According to present A. A. A. rules but twenty-seven entries will be allowed on the track in one event, but this is more than enough, as it is not the number but rather the caliber of the cars and drivers that makes a great contest.

Elimination Trials Will Be Needed

Undoubtedly with three big American speedways there will be a great increase in the number of entries, and elimination races of 100 miles or more will be needed to evolve those who are going to start in the final race.

New York has long talked about a speedway but it has all been talk until today. Now the money is up, the paper signed and the régime of reality has dawned. Here racing in America had its inception, in the Long Island race of 1900 when Riker, in an electric, carried off the honors, leaving the gasoline and steam machines far behind. Later the Vanderbilt Cup race became an annual classic until taken to Savannah, Milwaukee and lastly to the Pacific Coast. But Gotham is once more to come into its own by a speedway that promises to excel all others.

Should Draw Huge Crowds

If Indianapolis with a population of only 233,000 can muster a crowd of 100,000 automobile race enthusiasts, New York City with 5,000,000 people and as many more within easy automobile touring distance should furnish at least double the attendance which is found each year at the Hoosier speedway.

Human Element Determines Success or Failure of Jitney Movement

Operator Must Be Industrious, a Good Business Man with Mechanical Ability—$10 Average Daily Receipts—Specifications of Kansas City Buses

KANSAS CITY, MO., April 10—Three months ago the big cities of the East began hearing of a remarkable system of motor transportation that suddenly had appeared as if by magic in the Pacific coast cities. From there it jumped to the cities of Texas and then to Kansas City and the Middle West. On it went, sometimes with a rush; especially in those cities where street car companies had herded their patrons into cars like cattle, while in other cities it appeared in a more desultory fashion.

The jitney fever broke out in the early winter in the coast states and Christmas found it with a foothold in Texas. Reports from Los Angeles last week said 1,200 cars were in operation there and the southern cities were all winter breeding grounds for the 5-cent motor passenger carriers. With the advent of warm weather in the more northern states, it is possible the same development will result there.

Warm Weather Breeds Jitneys

So far the jitney numbers have increased in the direct ratio to climate and city ordinances. Where the days have been warmest and the laws the least rigorous, the jitney numbers have increased the most rapidly, which doesn't mean, however, that the business has been established on a successful basis. There are many other considerations to be taken into account, but, as conditions differ in various cities, it is to be expected that the new industry will show different degrees of prosperity.

Perhaps the jitney experiment in Kansas City will serve as well as any other upon which to base observations as to the future of this mode of transportation. Kansas City has had the jitneys for 3 months, the first cars having been in operation since January 18. The weather since that time has been uniformly bad until the last few days. It has been cold and dreary and much of the time snow has been on the ground. The streets have been in a miserable condition, due to wornout pavement and the car that operated without side curtains up and, for much of the time, chains on the wheels, could not expect to do business. In addition, the jitney owners were harassed and discouraged by a series of council committee meetings that began with the expressed determination of regulating the jitney cars so that the new method of travel would be safe. The city councillor who has helped to draw a franchise for the Metropolitan street railway company here, giving that bankrupt company a 30-year franchise, gave the committee a draft of an ordinance to work upon for jitney regulation. The entire city administration and both houses of the council are tarred with the Metropolitan stick and it was realized that unless public sentiment came to the rescue, the jitney would be choked to death. A rather discouraging condition in which to develop a budding industry, yet one which in more or less degree has confronted the jitney wherever it has appeared. In some cities the jitney has crept into political campaigns, candidates standing for or against the new method of transportation.

Now in Kansas City, the council has not yet acted and this danger still hangs over the jitney, but the automobile dealers, the jitney owners themselves and the labor unions, have showed a strong enough front to hold the proposed ordinance up indefinitely. This ordinance proposed a $5,000 to $10,000 liability bond, depending upon the size of the car; a license tax of from $5 to $10, depending upon the size of the car; a 15-minute schedule; the obtaining of special permission from the park board for jitneys to cross boulevards and special permission from the board of public works to use the streets. The liability bond would cost not less than $150 a year for the smallest case, if obtainable at all, although one or two companies have announced they would write jitney insurance at that price. And one good-sized company is doing so in Los Angeles.

On the other hand, the jitney drivers have had in their favor, which has acted as a development in their business, an almost intolerable street car congestion, slow transit and admirable newspaper support. Police regulation has not been severe.

These conditions must be fully understood to be able to draw conclusions as to the future of the business.

Now, bearing all these things in mind, we come to what the actual development has been and what the future holds out.

The first week with bad snowy weather found sixty cars in operation. These cars made short hauls mostly, from the union station to the retail district; from the wholesale district to the wholesale district and from 2 to 3 miles out on the various street car lines into the residence districts. The cars ranged from the cheapest touring cars to the highest priced, although none of the high-priced cars were new. Most of them were very badly used and abused cars. Some of the cheaper cars were new.

After the first week the buses made their appearance. They were of all types, some of them moving vans with solid tires. These lasted only a few days. The people would not ride in them. Some of the buses were home-made bodies on touring car chassis. Some seated six passengers, some seated ten and twelve persons and some as high as twenty. Some had long routes and some short ones.

Drivers, Like Cars, Vary

The class of drivers and owners has varied as greatly as the condition of the cars. Some have been careful, business-like men sobered by families. Others, and these have been in the large majority, have been careless, irresponsible men who thought driving a jitney lots of fun and an easy way to fortune. These men have had accidents, breakdowns, police arrests and have been a peril to traffic generally. Many of these have been forced out of business already.

The number of jitneys, sixty the first week, increased during the cold weather to 150 at one time and then dwindled on the coldest days to half that number. Warmer days brought many of them back and now there are 350 cars operating. A month of pleasant spring weather may see the number up to 600 or more.

56 Per Cent Survive

After 3 months of operation, by careful investigation it is found that of the first 100 jitneys in operation, fifty-six are still paying their dues of $1 a week to the central organization at the uptown terminal and are in service the

greater part of the time. Twenty-six of the first 100 have been in operation almost constantly.

In getting at the future of the business only the fifty-six of the first 100 need be considered. Perhaps it will be best to consider only the twenty-six who have been on the job faithfully. If the business has a future it will be men of the type of the twenty-six that will place it there. Now what are their qualifications and what have they proved?

A representative of THE AUTOMOBILE talked to a half dozen of these men. They had various types of machines from the small touring car to the twelve-passenger bus. Nearly all of them had hazy ideas of the cost of running their cars and all their figures differed.

It would be more or less useless to give the figures of earnings of the various kinds of touring cars and buses. But it will be illuminating to take the bus that has apparently been the most profitable and the touring car that apparently has been the most profitable and from that estimate their chance of success.

Twelve-Passenger Prosperity

Consider the case of Charles Thomas, who starts into business with a twelve-passenger bus on a straight haul without bad hills and a 2.5 mile trip. The round trip is 5 miles. Thomas averages two trips an hour and drives from 7 a. m. to 7.30 p. m., sometimes making an extra trip. He will average 125 miles a day. His bus has been in service 41 days. He has worn out two sets of 35 by 5 rear tires and one set of front tires. He figures his tire expense in that time at $150 in round numbers. He figures his oil and gas in that time has cost him $61.50; about $1.50 a day. He figures a new bus in 2 years at a cost of $1,300 and allows $2.50 for a repair and new car fund. This figures nearly $8, not counting licenses, accidents, insurance (of which he has none) and incidentals. Since he started with 21 days of cold weather and the rest of fair weather, he has averaged $13 a day. He has averaged on the pleasant days as high as $19 a day. Thomas says he can make his bus pay and pay $150 a year for insurance and $50 for license tags.

Now every bus is a modification of the Thomas bus. Some run farther and the driver may not be as smart a chap as Thomas nor so energetic. But, almost to a man, the ten and twelve-passenger light buses appear to be making from $3 to $8 a day. Some of the drivers are creating a sinking fund. Others will live themselves out of business and in a year or two will have neither car nor money to buy a new one. This twelve-passenger jitney which seems to be first choice and which the new jitney company here formed by W. H. Miller, father of the jitney service, has put its faith in to the extent of ordering forty buses, embraces these specifications:

CHASSIS

Frame, length—170 inches.
Frame, width—30 inches.
Frame, overhang—36 1-4 inches.
Body, overhang—8 3-4 inches.
Front springs—semi-elliptic.
Rear springs—elliptic.
Wheelbase—116 inches.
Size motor—3 1-2 x 5 inches.
Number of cylinders—4 block.
Rims—Demountable, quick detachable.
Tires—35 x 5 safety tread, rear; plain, front.
Weight complete—3,400 pounds.
Capacity—2,000 pounds.

BODY

Length inside—131 inches.
Width inside—59 inches.
Height inside—65 inches.
Capacity—13, including driver.
Seats arranged lengthwise.
Entrance and exit—Front right side, door operated by driver from seat.
Type—Pay-as-you-enter.
Price complete—$12,235.

This bus is fitted with glass windows which may be unscrewed and removed in summer and curtains roll down for protection from storms. The door is opened by the driver by means of a lever and the coin box is on the door, into which the passenger drops a nickel.

The body is not mounted on a passenger car chassis, but is designed especially for the use to which it will be put and should be good for 150,000 miles, and last 2 or 3 years in the jitney service, it is estimated.

There is still much to be learned about the profits of the jitney business. So far the biggest receipts of 1 day here have been $31.25 for one bus, running from 7 o'clock in the morning until 11 o'clock at night, with 4 hours of idleness at slack traffic hours. The lowest mark for a day's work is below $5.

$10 Is Daily Average

The general average for the buses has been about $10 a day under the worst circumstances of weather and other conditions. The average of the little jitney is much less.

Frank Mulkey, who has been driving a Ford car since January 24, has kept accurate account of his expenses and receipts in March. He runs 2 1-2 miles, paralleling a street car line and works from 7 o'clock until 7:30 each day. On Sunday he only handles special trips and then but infrequently. Twenty days in March show that he took in $153.20. His expenses for gasoline, oil, garage rent, jitney association dues and repairs were $49.78. The net was $103.42, or approximately $5 a day. Of this he charges off $1.50 a day for depreciation on tires and car, leaving $3.50 profits. He quit a $15 a week job as driver of a truck to go into the business and he expresses entire satisfaction at the change.

Mulkey knows something of mechanics and takes care of his own car, and thinks it will last more than a year. It was 6 months old when he went into the jitney business. For car depreciation he charges off $1 a day and for tires 50 cents a day.

Finds Speed Advantageous

On the same route with Mr. Mulkey is another man with a Ford, J. Beery, who plans to make at least $10 a day and who averages nearly $11, as against Mulkey's $7.50 average. Beery does this by fast driving, more trips and by jockeying for position. He makes four trips an hour in rush hours, which means over 20 miles an hour, including stops. His gasoline and oil bill is about $1.50 a day, as against Mulkey's 80 cents. Beery either drops several blocks behind the other jitneys on the line or he always leads. Preferably he gets ahead of a street car and picks up the waiting passengers until he gets a load and then he turns over on a street on which there are no car tracks and whisks his car down town at top speed. Speed does it, for he will not carry more than six passengers while Mulkey has carried eleven passengers seated in and hanging on his car. Beery also expects his car to last more than a year. As to tires, he is satisfied if they last a month. He figures that he makes money wearing his tires out quickly, getting the maximum service from the tires per mile and larger profits.

C. C. Meade, manager of the local assembling Ford factory, declares that the Ford cars in the jitney service will undoubtedly last 2 years but he is neutral in regard to sales of cars for the jitney service.

The jitney business is still on trial here, but there are certain things which may fairly surely be said to have proven their impracticability. The stern wheeler bus has been abandoned. This is the bus with a step on behind, and using a conductor in addition to the driver. These were seven-passenger chassis mostly with hastily made bodies. The objection to them is the unequal weight distribution.

One could go on indefinitely citing figures, but a summary of the situation appears to be this:

Summary

The bus driven by a private owner where overhead expenses are not counted, costing less than $1,500, seating ten to twelve passengers, with oversized tires, and a good route can clear from $5 to $10 a day, provided: that the owner is a fairly good hand at tinkering in mechanics; that he is industrious and has a fair amount of business acumen. And the same thing may be said of the small car costing less than $700 new or second hand, except that profits will be $2 to $4.

The Engineers' Forum

Thinks Trend of Design Could Be Improved—Refined Simplicity Better Than Complex Experiment

By Charles Ethan Davis

NEW YORK CITY—Editor THE AUTOMOBILE:—A backward look at the business side of automobile manufacture seems to point to what may be termed Germ Invasion.

Many of the engineers who were guests of the English Institute of Automobile Engineers 3 years ago heard a great many complaints of the American invasion, the attack at that time being directed against the cheap car in general and the Ford in particular.

What are the periods of the Germ Invasion that have left a marked influence upon American cars, and what have been the results to the investor and manufacturer?

Among the first microbes to appear in any business which has had even a fairly profitable pioneer is the imitator, who, attracted by what seemed to be large returns for small initial investment, seeks for capital and by incomplete data and assumption of large engineering experience and manufacturing knowledge succeeds in securing a limited investment which it is promised will be sufficient to launch the ship and operate it until returns on sales are sufficient to continue the voyage to port.

What has been the result? Wonderful, in a few of the pioneer ventures; but what of the 104 or more imitators which are either total wrecks or breaking up on the rocks of credit extension or re-organization since 1907? Of these seven occurred in 1910, eight in 1911, twenty-two in 1912, forty-four in 1913 and twenty-three in 1914, and at least two seemingly prosperous corporations decided in 1913 and 1914 to abandon the voyage because the profits did not warrant its continuance.

Current records shows about 128 companies are still afloat, fifty of which are in the strong credit class.

American Engineer Leads

Several bacteria seem to have combined to produce the above results, aside from an inadequate conception of the fundamental problem, namely, to produce a simple, clean-cut, reliably-made, easily operated and economic means of transportation to replace the horse, street-car, railway train, bicycle, etc., for pleasure or commerce. To design such a universal servant of mankind calls for a very wide engineering knowledge, and while the results have never been greater in any field in the same time, on the other hand many men with superficial ability have contributed to the disasters. The field can now be said to have settled down to the survival of the fittest, and though for a time the foreign engineer held the supremacy because of more careful and thorough training, the American engineer today is in the forefront of achievement.

The Ford, a pioneer germ, was very early manifest and still is the striking example of the work of a man inoculated with the fixed purpose to put into the hands of the masses a well-made, reliable and economical automobile which will transport them comfortably, quickly and surely where they wish to go either for business or pleasure, at a price which will secure them a very low mileage rate and upon which they may rely for uniformity and interchangeable parts as the years pass. It needs only the record of the number of cars in use and the profit sheet to demonstrate the success of this germ for employer, employee and user.

Stop, Look and Listen!

About the same time the above pioneer germ appeared, or possibly earlier, there was a manifest desire for the foreign luxurious car and several licenses were secured for the manufacture of Americanized French, English, Italian and German cars, all to be sold to the necessarily limited class who can afford to maintain a luxury. What the business and financial result has been is shown by the names which still survive; those which are no longer on the profit side of the ledger are so numerous, and new names are so frequently added that it is time to Stop, Look and Listen, before new ventures are made in this direction.

Following these came the assembled car enterprise with its sidepartner, the parts maker. The result of this invasion has been the production of cars which have luxurious appointments at a greatly reduced price to the user, and a number of notable profit-showing corporations still in the race; but many others strew the road who have been skidded into the ditch by unskilful management, too much speed or a failure of financial fuel supply at the critical stage in the race. As for the parts making sidepartner he has always, and recently more than ever, staggered under stresses which require constant and varied heat treatment to maintain the elastic limit high enough to supply any safety factor to carry the load.

Knowing How

The Gamaliel of automobile engineering and manufacturing, H. M. Leland, at whose feet as students we are all glad to sit, said in his valedictory address on retiring from the presidency of the Society of Automobile Engineers:

"There are two magic words which are the most potent that can possibly be used to express the essentials of success in the manufacture of automobiles on a large, permanent and successful basis: 'Knowing How.' "

First, and most essential in this regard is the selection of a not too extended organization to carry out the details for the one who knows the requirements of shop management and who will not be side tracked from vital issues to make experiments that call for numerous untried changes and additional outlay. In the writer's opinion, germs have been allowed to clog rather than purify by attempting to replace immediately and in all departments old and proved methods

• EDITOR'S NOTE—Charles Ethan Davis, writer of this article, has had exceptional opportunities for studying automobile trade conditions both here and in Europe. When general manager of the Warner Gear Co. he came into close touch with manufacturing conditions in automobile factories of all kinds. There is probably no single automobile factory of any size in the world which he has not only visited, but studied on the spot, and his opinions are therefore based upon an extremely wide and unusual experience.

by new and largely theoretical ideas which not even the suggestors had any practice in applying, with the result that failure followed before the power to act intelligently was acquired. Equally important is the building up of a force of workmen who have a personal loyalty to the enterprise and management and the ability to manufacture a stable output.

M. W. Alexander of the General Electric Co. read a paper recently before the machine tool builders which was published in the Scientific American Supplement of February 13, setting forth very startlingly the economic loss due to floating labor and its relation to success or failure in manufacturing. The large demand for workmen to fill shop positions and the heavy drain on the supply of trained mechanics due to their leaving the shops to act as chauffeurs has made it almost impossible to supply all round mechanics, and, worse still, it is extremely difficult to interest the young men of today in learning trades, so there is a dearth of men who really know how.

The above takes no account of the necessarily increased cost of product due to higher wage, decreased output and greater waste because of this lack of men who have gray matter heads and trained hands.

Accessory Complications

The next epidemic that appeared was the struggle of the business management to keep up with the wild desire for a new model each year and for novelty and talking points to help the salesman to dispose of an increased product at maintained prices. The result is the addition of all sorts of accessories and devices, largely good in themselves, but not indispensable, and resulting in complication and increased operating and mileage expense, when after all, we ride only the same number of miles in the same time. A further disturber is the failure to hold down the variety of product by the sales and engineering departments and the too free promise of continued care of the cars in the hands of the user, regardless of use or abuse.

We might continue almost indefinitely to enumerate the germs of motor design, gearshift, self-starter, electric lighting, noise removal, worm gear vs. spiral bevel, right v. left steering, etc., all good, but are they all essentials for the everyday user? If not, who has counted the cost of equipment for their manufacture or the loss caused by making obsolete the plant installations already made?

The Eight-Cylinder Germ

What of the latest eight-cylinder motor germ which has caused several manufacturers to put new and in a great measure untried models on the market following the lead of the Cadillac? It is true there are great claims and many talking points for luxury and anti-fatigue riding qualities which can no doubt be sustained, but have the makers taken into full consideration all that it means to the user to familiarize himself with the added complications and so be able to locate and correct trouble on the road? Who has demonstrated that the simple car cannot be made so comfortable that only an expert can detect the difference in riding qualities?

It is told that a fanatic on quiet sewing machines once asked the Singer Mfg. Co. why they did not put out a new, silent model. The reply was, "Our machine sews, lasts and the public is educated to its use. What increased profit would a change secure us?"

The question is often asked, has the ultimate high- or low-priced car yet been produced? Probably not, but the public knows how to use the present vehicles, and profits will continue to swell the bank accounts at least until many of the existing plants have been charged off as a part of manufacturing cost.

Refined Simplicity

But why elaborate further? The cases are too numerous and similar to require a diagnosis for each new symptom. "The issue of a bacterial affection is either the death of the patient or the elimination of the bacteria." The writer was once convinced that a germ had gained a foothold in his system and a physician of wide experience said to him, "I am old and have been in practice long enough to tell you to let medicine alone and give Nature a chance." In the light of this advice, is it not a wise policy for many of the established manufacturers, if not all, to let complex experiment alone and give refined simplicity a chance?—CHARLES ETHAN DAVIS.

Dashboard Location of Radiator Best for Trucks

NEW YORK CITY—Editor THE AUTOMOBILE:—The position selected for the radiator on almost all cars is, with the exception of the position for the headlights, the most exposed on the car. It would be almost impossible to plan the radiator anywhere on a car where it would be more likely to become damaged. At the same time, the radiator is comparatively frail and easy to puncture.

That passenger cars should have the radiators in an exposed position is not strange, but that commercial trucks and army automobiles should have the radiators stuck out in front seems absolutely absurd. The position in front is accessible and cheapens construction, but these advantages are far more than offset by the possibilities, or rather probabilities of damage.

Radiators Invite Trouble

Some trucks are provided with a heavy bumper but this is only slight protection and practically none at all for army use. A water-cooled motor is helpless without a radiator, yet one well-directed shot, the pole of a wagon, or even the fender of another truck, will put the unprotected radiator out of commission. In spite of this fact recent U. S. Army trucks have the radiators stuck out in front where they simply invite trouble.

A radiator on the front of a car is extremely hard to protect, but the radiator can be placed where it is amply protected and where a car must be practically demolished before the radiator would be harmed. This position is directly back of the motor in front of the dash.

For passenger car work, this position is particularly desirable as the radiator is not only secure from injury but the car can be constructed with perfect stream lines. With the radiator in this position the lamps can also be protected by placing them further back.

Radiator at Dash Would Be Better

On trucks for commercial use, the position back of the motor would eliminate many repair bills and much lost time. For army use the position seems to be the only practical one as it permits perfect protection which can be secured in no other position.

An additional advantage in cold weather is that the heat from the radiator could be used to warm the front section of the car.

The location of the radiator back of the motor presents no great engineering or constructional difficulties as the application could be made in a number of ways to suit the construction of motors and cars. It would even be possible with this construction to completely enclose the motor so that it would be free from dust and dirt yet readily accessible.—C. J. MORRISON, Chief Engineer Meyer, Morrison & Co., Inc.

The Rostrum

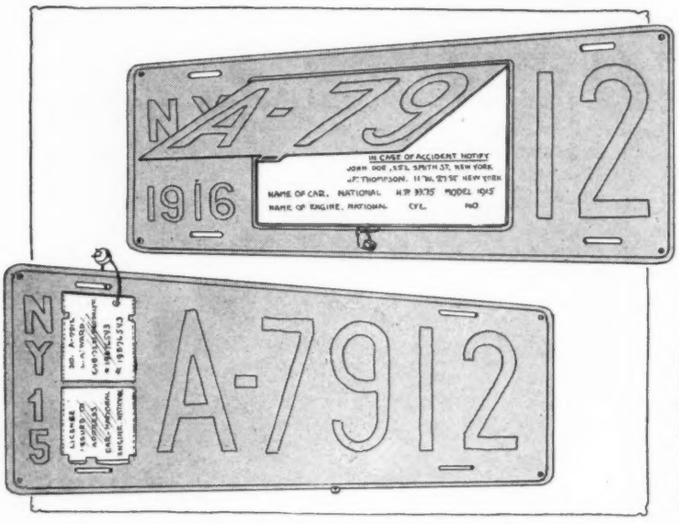


Fig. 1—Two methods by means of which a reader suggests identifying owner and driver of car. Upper shows identification card concealed by flap and license plate which is sealed by an official and only read when necessary. Lower shows method by which identification card is always visible behind a transparent medium

Carbureter Fuel Nozzle Incorrect

Editor THE AUTOMOBILE:—I have a 20-horsepower Hupmobile and have had new piston rings put in, the valves ground in well and have a new Breeze carbureter. It starts easily enough and as the motor runs idly it skips once in a while, then when I speed it along and put in first speed it runs fast, when I put in the second speed it slows up as if it were pulling a big load and then picks up again, first hitting on one cylinder then two, finally four and runs perfectly on the level. When I get to a grade it slows up and I have to put in the low speed and it climbs to the top of the hill. I have had it adjusted all sorts of ways but it still acts the same. After taking the manifold off I find it moist and I think it feeds raw gas. When I speed up the motor and then slow it up it runs slowly and misses fire once in a while, but if I want to make a quick getaway it again becomes balky. When it gets sucking in gas it finally hits on four cylinders and when I put it in second speed it slows up. I cannot go up any kind of a grade on high. This is a 1911 roadster and I never could get it to climb hills. I once saw it go up a hill with three people on high gear and now it won't go up with me alone. After getting it all overhauled the same trouble is found. Some people claim the spray nozzle in the carbureter is at fault. What do you think it can be?

Bridgeport, Conn. J. E. MICHAEL.

—The size of the fuel nozzle on the carbureter seems to be incorrect, and if you will get into communication with the makers of the carbureter they will no doubt correct it for you. Another possibility is that the spark plug points are spread too far apart and you are not getting good ignition at low speeds. The probabilities are, however, that all the trouble is in the carbureter. The spark plug points, should you adjust them, should be gauged by the thickness of an ordinary business card.

Car Should Carry Ownership Guarantee

EDITOR THE AUTOMOBILE:—I wish to present to your readers a new idea for license numbers attached to automobiles. It is my idea to provide a license number with a sealed pocket which shall contain a card supplied with material facts for the identification of the driver and owner of the car, the card to carry all the information demanded by the state, and in addition thereto to carry names of two parties to whom the automobilist or owner is known. The card is preferably to be sealed within the license plate either fully inclosed or such portions of the card in sight as to enable the authorities to promptly and immediately identify the car with its owner.

Under the present law, the state supplies the applicant (presumably the owner), with two distinct number plates and a certificate of registration which certificate contains the material facts supplied the state by the applicant. The law further tells the applicant that he must put the number plates at either end of his car, but does not tell him what to do with the card, although some states demand that the driver of the car shall have with him on his person or in some accessible place, the certificate of registration.

Identification Insured

It is my idea to provide within the license plate a place to securely seal the registration card, either partly or wholly in sight, or wholly out of sight as may be deemed advisable. This method of carrying the information demanded by the state is therefore available at a moment's notice and carries many special advantages, to both the owner and the authorities, among which are:

1—That the authorities would have immediate and first-hand information as to the owner of a car in event of accident or transgression of the law.

2—Authorities have immediate knowledge of friends of injured parties and where they can be found.

3—Authorities have an immediate and practical identification of cars which have been either abandoned or so positioned as to interfere with traffic that they must be taken to the station.

4—By a slight amendment to the act, the certificate of registration may be made the certificate of title to the car, transferable only at the office of the secretary of state.

Advantages to Car Owner

On the other hand, the peculiar advantages derived by the owner of a car are:

1—That the state provides a secure means of his, the owner's, identification.

2—A reliable safeguard against theft of the car, as whoever was in possession of the car must always be able to identify himself with a certificate of registration.

3—An immediate identification in event of accident and a prompt notification to friends.

4—A certificate or title of ownership which prevents the car being transferred or sold without the knowledge or consent of the party to whom the license and certificate are issued.

A canvass among owners of cars developed the fact that, although all of the cars were properly registered and carried their license numbers properly attached to the car, less than 15 per cent. of the owners of the cars had with them their certificate of registration, and would be absolutely unable to identify themselves with the car in event of any dispute of ownership.

It is my idea that the ordinary means of identification demanded by banks and like institutions shall be available by the owner in identifying himself with his own property. In this way any person driving a car not his own would have difficulty in establishing his right to that car unless provided with ordinary means of identifying himself with the party to whom the sealed certificate is made out.

Wants Readers' Opinions

I would like to hear from other readers on this, stating whether or not in their opinion this system would be advisable and also if they know of concrete examples where such an identification would have been of value.

Within the past few days examples have taken place that could not have happened had the license plate of the automobile contained such information. In one instance a man arrested for driving an automobile without a license left the car with the authorities as security for his appearance. Authorities later discovered the car was a stolen one. A second example was an accident on the Queensboro Bridge in which the automobilist was taken to the hospital and died there without the knowledge of his friends. In the first instance, the authorities should have held the man as not being properly identified with the car, and in the second instance the friends of the automobilist could have been communicated with at once from the knowledge displayed in the suggested method of connecting ownership with the license number.

Brooklyn, N. Y. L. A. WARD.

Information on Storage Battery Care

Editor THE AUTOMOBILE:—How can you remove a jar from a Willard storage battery box when it is fast to the container?

2—What kind of acid is used to remove the solution from the positive and negative plates?

3—What do you use to replace the solution in plates again? Please state how to mix same for each plate.

4—How can you straighten a buckled plate in a storage battery?

Conway, Kan. T. J. GARTNER.

—In repairing a Willard storage battery a definite routine must be followed in tearing down and building up same in order that it will be in the best condition when re-assembled. These steps are as follows:

First: Remove all vent plugs and washers.

Second: Centerpunch both top connectors in each cell which is to be repaired; then drill 3-4-inch into top connector, with a 5-8-inch diameter drill. Now pull off top connector with pair of pliers, Fig. 2.

Third: Apply gas flame or blowtorch flame to the top of the battery long enough to soften the sealing compound under the top cover. Now, with heated putty knife, plow out the sealing compound around the edge of top cover.

Fourth: Insert a putty knife, or any other thin, broad pointed tool, heated in flame, along underside of top cover, separating it from the sealing compound. Then with putty knife, pry the top cover up the sides and off of the terminal posts.

Fifth: Then, with heated putty knife, remove all sealing compound from inner cover.

Sixth: Now play the flame onto the inner cover until it becomes soft and pliable; then take hold of both terminal posts of one cell, and remove the elements from the jar, slowly; then lift the inner cover from the terminal posts.

Seventh: Now separate positive and negative elements, by pulling them apart sideways. Destroy old separators.

Eighth: To remove a leaky jar, first empty the electrolyte from the jar, and then play the flame on the inside of the jar until the compound surrounding it is soft and plastic; then with the aid of two pairs of pliers, remove it from the crate, slowly, lifting evenly.

Ninth: To put in a new jar, in place of the leaky one, heat it thoroughly, in a pail of hot water, and force in gently.

Tenth: In re-assembling the battery, first assemble the positive and negative elements, pushing them together sideways; then turn them on the side and with both hold downs in place, insert new separators, being very careful to have the grooved side of the separators next to each side of each positive plate. Also be careful to have the separators extend beyond the plates on each side, so there will be no chance of the plates short-circuiting. Now press all separators up against hold downs.

Eleventh: Heat up inner cover with flame; then place same on terminal posts; then take hold of both terminal posts and slowly lower the elements into the jar.

Twelfth: Now, with expansion chamber in place on the inner cover, pour the melted sealing compound on to the inner cover, until it reaches the level of the hole in the top of the expansion chamber,—*i.e.* so that when the top cover is replaced, it will squeeze the sealing compound off the top of the expansion chambers.

Thirteenth: Now soften top cover with flame and replace on terminal posts until it rests on top of expansion chamber; then place a weight on top cover until sealing compound cools.

Fourteenth: Now, pour sealing compound around the edge of the top cover, until it reaches the top of top cover; then when the sealing compound has cooled, take a putty knife and scoop extra sealing compound off of top cover, making a smooth surface over all the top of the battery.

Fifteenth: In burning the top connector to terminal post, proceed as follows: Scrape the hole of the top connector until the surface is bright and clean; scrape terminal post until top and edge are bright and clean. Now, scrape a piece of lead—preferably a small bar—bright and clean; then apply hydrogen gas flame, mixed with air under pressure, to the top connector and terminal post assembled, at the same time heating lead bar. When top connector and terminal post begin to melt, apply lead bar directly on same, melting it, thus making a firm burned connection. Then fill rest of hole-space with melted lead and smooth off even with top of top connector.

2—In this question you no doubt refer to sulphation rather than solution and no acid of any kind is required to remove

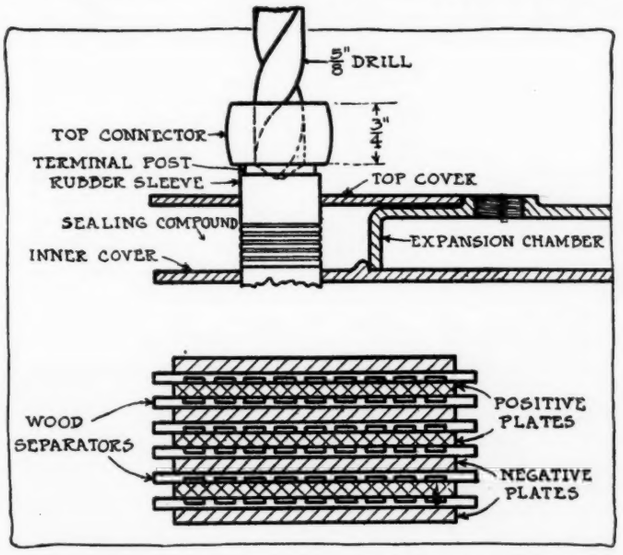


Fig. 2—Diagram showing construction of points to be reached in the rebuilding or tearing down of a Willard storage battery

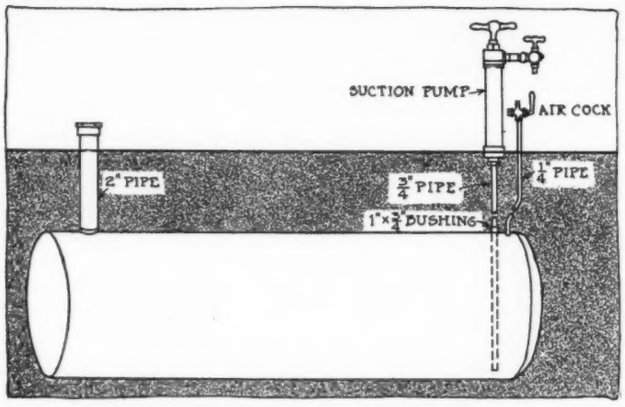


Fig. 3—Gasoline storage tank buried beneath surface of ground, showing size of pipe generally used

it. If the plates are not too hard from this cause, sulphate will be removed by continued charging at a very low rate which in most instances should not be higher than the finished rate given on the name plate of the battery.

3—This question seems rather indefinite unless you refer to the electrolyte in the battery. The electrolyte in Willard batteries is of 1.285 density and is composed of about three parts of water to one of chemically pure, 1.842 density sulphuric acid. Unless you are entirely familiar with battery practice it would be inadvisable for you to attempt to replace the electrolyte in the battery.

4—It is impossible to straighten buckled plates in a battery of this type. A paste plate that is buckled can under no circumstances be straightened.

How to Sink a Gasoline Tank

Editor THE AUTOMOBILE:—Will you please advise me the best method of sinking a galvanized iron drum for the purpose of underground storage of gasoline?

2—What sort of bed should be made for the drum and the different connections of piping, together with size necessary to connect it with the garage?

New York City. STANLEY FULLWOOD.

—The best method of sinking a galvanized iron drum for the purpose of underground storage of gasoline is to line the well in which the tank is to lie with some hard material such as brick or concrete that will not sink unequally afterwards and put strain upon the tank connections. There are many methods suggested by different companies in this business and a few examples may be of value to you. Janney, Steinmetz & Co. state that the best method of sinking such a drum, both as regards the life of the drum and cheapness, is to paint the tank thoroughly with a good asphaltum paint or smear thoroughly with tar. After the hole for the tank is made, put in this either a tarred paper or burlap, smearing the tank thoroughly with asphaltum or tar and then folding over it the burlap or tarred paper. The asphaltum or tar is again daubed over the tank after this is done, after which the ground is filled in and, according to the estimate of this company, the tank should be good for 50 or 100 years.

L. O. Koven & Bro. state that it is customary simply to dig a hole in the ground and place the tank therein, making the pipe connections and then closing with earth. This company does not approve of this method, however, but believes it better to dig a pit so that the top of the tank will be about 3 feet below the surface. The base is then made with cement into which bricks are laid, a brick wall built to a thickness of 8 inches. This brick wall should be extended up to the surface and provided with a cover made of steel plate so that if it is desired to get at the tank the tank cover need merely be removed.

The Cleveland Faucet Co. states that all that it is necessary to do is to dig a hole large enough to hold the tank, then give the tank about three coats of asphaltum and drop it into the hole so that it will come about 18 inches below the ground. The accompanying illustration, Fig. 3, shows the position of the tank, stand pipe, pump, etc.

The American Oil Tank & Pump Co. warns the user of subterranean tanks against placing the tanks where cinders come in contact with the metal as these cause corrosion, making the tank rust through very quickly. This company advises placing the tank from 24 to 30 inches below the surface and states that it should be placed level on a concrete base, the base consisting of a slab of concrete about 6 inches in thickness. This is necessary in order to prevent the tank from settling at one end, thereby causing a strain on the pipe fittings which would cause air leaks and prove troublesome. Two coats of paint are recommended.

The Wayne Oil Tank & Pump Co. states that in about 99 per cent. of the cases the tank is simply buried in the ground and that a much better way is to spend a little more on the installation and build a concrete base in the bottom of the excavation on which to set the tank. However, according to this authority, this is not necessary except in a few extreme cases. The nature of the ground and the conditions under which the installations are made govern this point to some extent. A tank should never be buried in cinders, ashes, sawdust or anything else that has a tendency to create an acid. If the installation is to be near the coast where the salt water from the ocean will seep into the opening the tank should be set in a concrete vault. If, on the other hand, the tank is to be set in ground that is not affected by any of the elements named, the only procedure necessary is to dig a hole and bury the tank.

2—The sizes of piping used for the tanks will depend largely on the size of the tank itself. The Cleveland company uses a 2-inch iron pipe opening for a filler, a 1-inch iron pipe opening for the discharge pipe and a 1-2-inch iron pipe for vent. The Wayne company states that ordinarily the size of the suction pipe for a pump will be 1.25 inches.

Aligning Reamer for Truing Crankshaft

Editor THE AUTOMOBILE:—As a mechanic of automobile work I would like to have a little information on the subject of truing up crankshafts. As we all know, this is not a hard job when you have a crankshaft grinding machine or a lathe for which you have the proper head and tail stock attachments for throwing your shaft out of center to turn the connecting-rod bearing. It often happens that a repair man will have to go to some small country town and overhaul a motor, and very often he will find a badly scored and cut shaft, and almost always he will find that his main, generally the center and connecting-rod, journals are out of round. I have found them out of round as much as .010 inch and the crankshaft very often sprung, this being more so in older motors. One cannot do a good job, or one that will stand up with the shaft, in this condition, although many men who call themselves repairmen put them up in this condition, and they wonder after the car has run a few hundred miles why the bearings already pound. Very natural—the first thing that I do in a case like this is to take a file and micro-calipers and round up my bearings. This is easier said than done for it is almost impossible to get a perfectly round bearing. Then I take emery cloth and a strap and work out the file marks, then finer emery cloth and oil and polish them. This all takes a lot of time and skill.

Now what I am trying to get at is this—do you know of any tool or method that will accomplish this work? It should be such that it can be used for any length and diameter of bearing, can be easily carried and handled and still do a good

job. If you or any of your subscribers do know of any such tool I wish you or they would give a description of same and that you would publish it in the Rostrum of THE AUTOMOBILE. I think this would interest more than only myself and be of great help to many of us in our work. I wish the repair men would make more use of this section of your paper. I know it would help to solve a lot of our hard problems and make it better for us all around.

Pittsburgh, Pa. A. R. T.

—In Fig. 4 is illustrated an aligning reamer that will take care of this work for you. It can be carried about in a case and its use will result in bearings which are correctly bored.

Dry Batteries Should Be Used

Editor THE AUTOMOBILE:—I have a 1914 Regal T with starter and generator. I have never had any trouble with the storage battery of any kind, but have had a good deal of trouble with the four ignition dry cell batteries. I would like to know whether I could not substitute the 6-volt storage battery for the four dry cells, possibly using an extra switch to be held in by hand when starting to insure against the storage battery running down if the coil switch happened to be left on?

2—Would the difference in voltage be too great to connect without extra resistance?

San Francisco, Cal. C. P. GRIFFIN.

—Rather than go to the expense of a storage battery for this work, it would be probably better for you to use more batteries and connect them in parallel. The quality of current from the storage battery would be apt also to burn out the points of the breaker mechanism.

2—The difference in voltage would probably be quite noticeable and would result in the pitting of the platinum points.

Ohio Law for Licensing Chauffeurs

Editor THE AUTOMOBILE:—What examination does one have to pass to get a chauffeur's license in Ohio?

Scarboro, Me. L. C. H.

—Section 6302 of the Ohio automobile law states that: "A person operating a motor vehicle as a chauffeur shall file an application for registration in the office of the secretary of state accompanied with a registration fee of $2. Such application must contain the name and address of the applicant, a statement that he is competent to operate a motor vehicle, the trade name and kind of motor power of vehicles he is competent to operate, and whether or not such applicant has been convicted of violating a provision of this chapter, or the penal statutes relating thereto, giving the date and place of such conviction and the provision of law so violated."

Before any certificate of registration is granted to a chauffeur in the state of Ohio, according to section 6302 of the Automobile law, the applicant shall pass such examinations as to his qualifications as the secretary of state shall require. The secretary of state shall appoint examiners and cause examinations to be held at convenient points throughout the state as often as may be necessary.

Rattle Comes from Idle Pinion

Editor THE AUTOMOBILE:—I have a 1914 Cadillac and whenever I go down hill with the clutch out, or go over a rough spot with the clutch out, the universal joints rattle. What is the cause of this?

2—Can this be remedied?

Brooklyn, N. Y. L. W. E.

—Probably the rattle does not come from the universal joint but from the idle pinion on the rear axle. On this model Cadillac there is a two-speed rear axle which has two bevel pinions constantly in mesh. One of these is always running idly and the particular gear which is delivering the power from the motor depends upon the position of a dog clutch. When the car goes over a rough spot with the clutch out, there is a tendency for the drive shaft to revolve at an unequal rate of speed due to the inequalities of the road with the result that the idle pinion is alternately thrown backwards and forwards against the bevel gear with which it meshes thereby giving the rattling sound. There is always a certain amount of back-lash in these gears and the amount of noise will naturally depend on the amount of this play. There is no serious side to this as the noise only occurs at rare intervals and then is not the indication of something which is out of order.

2—It will be unnecessary to replace any of these parts but simply to have the gears readjusted bring these close enough together to overcome some of this back-lash. This adjustment was explained in the instruction book shipped with each 1914 Cadillac. These gears will run satisfactorily with a back-lash of from .004 to .008-inch only.

Wants a Test for Platinum

Editor THE AUTOMOBILE:—Some of the worst troubles that the repairman must meet with today are magnetos, coils and various other electrical devices in which someone has used imitation platinum contacts in place of genuine. The only way we have of judging whether the contacts are real platinum or not is to file them level and if they pit again in a few hundred miles running we blame the contacts, only to find occasionally that the trouble is elsewhere.

Can some chemist give us a simple test that will tell us the composition of the contacts or at least whether the platinum content is high or not?

New Bedford, Mass. F. S. F.

—The acid test can be given for platinum as it is not soluble in nitric acid, hydrochloric acid nor sulphuric acid. It dissolves, however, in nitro-hydrochloric acid combining with it to form the acid

$$H_2PtCl_6.$$

Iridium with which platinum is often alloyed is not soluble in nitro-hydrochloric acid unless it is in a very finely divided state.

Formula for Liquid Flow Through Jet

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for February 4, the statement is made, "If we have a jet of known dimensions we can calculate the rate of air flow past it that will be necessary to withdraw a definite quantity of gasoline per second."

Would you kindly give me the above formula?

Steelton, Pa. G. P. V.

—The basic formula for the flow of a liquid through a jet is $V = \sqrt{2gh}$. Where V is the velocity in feet per second, g the acceleration due to gravity and h the head due to the difference in pressure.

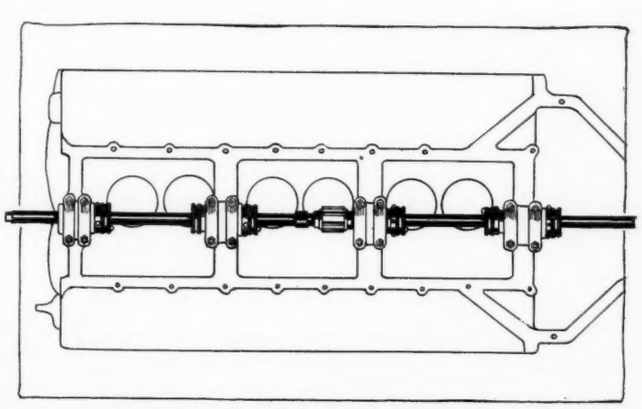


Fig. 4—An aligning reamer made for the purpose of properly aligning the main bearings in repair work

6-Volt Single-Wire Lighting Leads

Used on 86 Per Cent. of American Cars—12-Volt Used on 10 Per Cent. and 18-Volt Systems on 3 Per Cent.—Ford Uses 8-Volt Lamps

THAT practice often settles mooted questions is proved by the records of lamp and electric lighting practice as now in vogue among American automobile manufacturers. At the recent meetings of the Society of Automobile Engineers the question of the 6- vs. 12-volt lighting system and the corresponding debate on whether or not the lamps should be single or double contact have taken up hours of the valuable time of the annual sessions of the society. A study of the accompanying table shows that the 6-volt system predominates, having a percentage of 86. The single contact is also far in the lead, being found in more than 60 per cent. of the installations. The typical American car, therefore, will have a 6-volt system with a single-point contact.

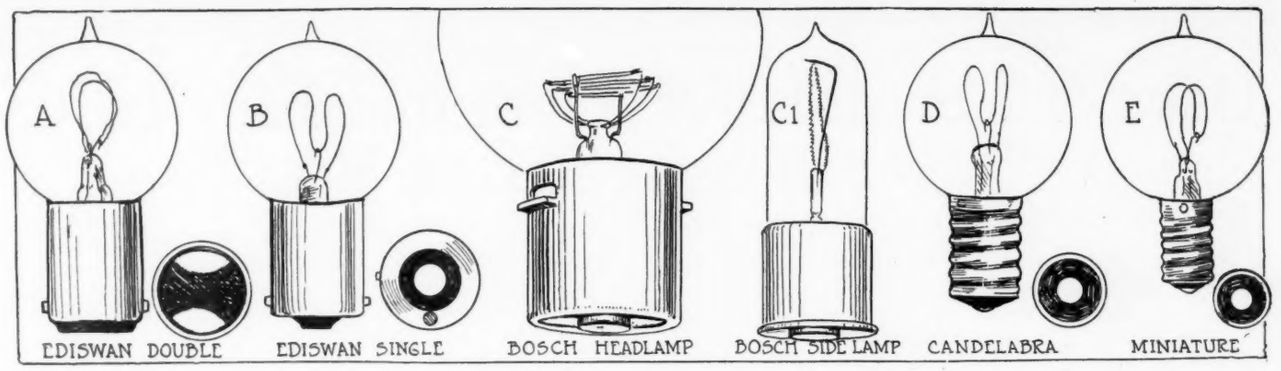
Voltage Varies

The voltage of the lamps, as far as rated capacity is concerned, varies considerably, even though the nominal voltage of the system be the same. Thus in the 6-volt system the use of 7-volt lamps is quite common. Also in the 12-volt system the use of 14-volt lamps will be found quite usual on many prominent makes. The multiple of 7 carries through the entire field, the corresponding voltage for lamps on the 18-volt system being 21.

The use of the 12-volt system has grown slowly since its inception and if the examples found in the tabulation below can be interpreted to cover the entire field, it is now used on approximately 10 per cent. of our cars. The 18-volt system is used on 3 per cent. The Ford car, due to its unusual generating apparatus, requires a voltage different from any of the other cars to prevent the lamps from being blown out through

Car	HEADLAMPS			SIDE LAMPS			TAIL LAMP			DASH LAMP			Make of Lamp	Socket	Wiring	Dimmer	Method of Focusing	Remarks
	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.						
Allen	6	2.5	15	...	...	...	6	.42	2	6	.42	2	Ed.&Jones.	Edswn D.	Single	Resist.	Set-screw adj.	
Ames	6	3.5	20	6	.75	4	4	.5	2	4	.5	2	McCandls.	Edswn D.	Double		Socket adj.	
Arbenz	6	...	20	6	...	6	6	...	4	6	...	4	...	...	Double	Resist.	Sliding sleeve	
Apperson	6	5.5	18	...	...	...	6	.5	3	...	...	...	Badger	Edswn D.	Double	Series	Outside adj.	
Auburn	6	2.5	16	6	1	4	6	.5	2	6	1	2	Solar	Edswn S.	*		Thumb-nut	*6-40 & 4-36 single; 4-43 & 6-47, double.
Austin	6	...	18	6	...	6	6	...	2	6	...	2	E.&Jones.*	Edswn S.	Single	†	Adj. socket	*Also Badger; †double bulbs in E-I & Jones; special controller on Badger
Briscoe	7	4	18	14	.5	2	14	.5	2	...	...	...	Brown	Edswn S.	Single		Adj. socket	
Buick, C24	6.2	...	16	...	...	...	6	...	2	6	...	2	Corcoran	Edswn D.	Single			
C25																		
C36	6.2	...	18	...	...	...	6	...	2	6	...	2	Corcoran	Edswn D.	Single			
C37																		
C54—55	6.2	...	21	...	...	...	6	...	2	6	...	2	Corcoran	Edswn D.	Single			
Cadillac	6.5	...	18	7	1.9	6	3.5	.37	2	3.5	.37	2	Br.-Marsh.	Edswn S.	Single		Screw adj.	
Cartercar	7	2.5	15	7	1.75	...	7	.42	2	7	.42	2	Corcoran*	Edswn S.	Single	Resist.		*Tail lamp, Copeland; dash lamp Culver-Stearns
Case	6	2.25	15	6	.75	4	6	.4	2	6	.6	3	Badger	Edswn S.	Single		Sliding socket	
Chadwick	6	...	20	6	...	4	6	...	3	6	...	2	E.&Jones*	Edswn S.	Single			*Tail lamp, Solar
Chalmers, 26B	21	1.78	21	...	.6	...	21	...	2	21	...	2	*	Edswn D.	Double	Series	Adj. bulb	*Model 29, Badger; Model 26B, Ed. & Jones
29																		
32	6	...	16	...	...	...	6	...	2	6	...	2	Ed.&Jones.	Edswn S.	Single		Adj. socket	
Chandler	6	3.5	18	6	...	4	6	...	2	6	...	4	Solar*	Edswn†	Single		Ratchet socket	*Dash lamp, Culver-Stearns; †Models 15 and 16—dash lamp double; all others, single
Chevrolet	6	...	18	6	...	4	6	...	2	6	...	2	Corcoran*	Edswn S.	Single			*Dash lamp, Warren-Douglas
Cole	6	2.5	21	3.5	1.3	...	4	.42	6	4	.42	6	Badger	Edswn S.	Single	Resist.	Adj. socket	
Corbitt	6	...	16	...	...	...	6	...	4	6	...	4	Gemco	Edswn D.	Single	Series		
Crow	6	1.5	6	...	...	...	6	.5	3	6	.5	3	Victor*	Edswn S†.	Double	Resist.	Screw adj.	*Dash lamp, Connecticut; †dash lamp, double
Davis	6	...	15	...	...	...	6	...	2	6	...	2	...	Edswn S.	Single	Resist.	Sliding socket	
Detroiter	6	...	16	6	...	4	6	...	2	6	...	2	Tulite	Edswn D.	Single		Screw adj.	
Dispatch	6	2.5	16	6	1.25	4	6	.84	2	6	.84	2	Hall*	Edswn S.	Single	Series	Adj. socket	*Tail lamp, Esterline
Dodge Bros.	12	1.75	16	...	...	...	12	...	2	12	...	2	Ed.&Jones.	Edswn S.	Single	Resist.	Adj. socket	
Dorris	6-7	2	15	6-7	1.33	4	6-7	1.33	4	6-7	1.33	4	Gray&Da.	Edswn S.	Single			
Driggs-Seabury*	6	2	10	6	...	4	6	.33	2	...	...	...	Indiana	Edswn D.	Double	Series		*Ritz and Twombly
Dudley	6	1.25	6	...	...	...	6	...	1	...	...	...	Hawthorne	Edswn D.	Double		Adj. bulb	
Empire	14	4	12	...	...	...	7	...	2	7	...	2	Indiana	Edswn S.	Single	Resist.	Screw adj.	
Enger	6-7	...	16	6-7	...	4	6-7	...	4	6-7	...	2	Gray&Da.	Edswn S.	Single	Deflector		
Fiat	6	2.5	15	7	.84	4	3.5	.42	2	3.5	.42	2	Badger	Edswn S.	Single			
Ford	8	2	16	...	...	...	...	...	...	...	...	...	*	Edswn D.	Single		Adj. socket	*Brown, Edmunds & Jones, Victor and Corcoran
Franklin	14	1.5	21	14	.42	4	7	.42	2	7	.42	2	Hall	Edswn D.	Double			
Glide	6	2.5	15	...	...	...	6	.5	2	6	.5	2	Corcoran	Edswn D.	Single	Series	Screw adj.	
Grant	6	...	15	...	...	...	6	...	2	6	...	2	Corcoran	Edswn D.	Single	Resist.	Adj. bulb	
Gt. Western	6	3.5	15	6	.75	4	6	.5	2	6	.5	2	Ad.-Bag*	Edswn D.	Double			*Tail lamp, Indiana
Haynes	6	2.25	16	...	...	...	6	.5	2	6	.5	2	Guide	Edswn D.	Double	Series	Adj. bulb	
Herff-Brooks	6	4	16	6	...	6	6	1	4	6	1	2	Indiana	Edswn D.	Double	Series	Screw adj.	
Hudson	7	3	15	...	...	...	3.5	.84	2	3.5	.84	2	Ed.&Jones.	Edswn S.	Single	Resist.		
Hupmobile	14	1.5	15	...	...	...	14	.5	4	14	.25	2	Hall*	Edswn S.	Single	Resist.	Adj. bulb	*Tail lamp, Ed. & Jones
Imperial	6	3	16	6	2	4	6	1	2	6	1	2	Gray&D.*	Edswn D.	Single			*Also Victor
Jackson	6	2.5	16	6	.84	4	6	.42	2	6	.42	2	Gen.Elec.	Edswn D.	Double		Adj. socket	
Jeffery	6.4	3	18	...	...	...	7	.42	3	7	.42	3	Solar	Edswn D.	Double	Series	Outside adj.	
Chesterfield																		
6-48	7	3	18	...	...	...	7	.42	3	7	.42	3	Solar	Edswn D.	Double	Resist.	Outside adj.	
King	6.5	2.5	15	6.5	.84	4	6.5	.42	2	6.5	.84	4	Br.-Marsh.	Edswn D.	Double		Adj. bulb	
Kissel	6	3	18	3	1.5	...	6	.5	2	6	2.5	2	Badger	Edswn S.	Single	Series		
Kline	7	4	25	...	...	...	7	.84	4	7	.84	4	Rushmore*	Edswn S.	Single	Resist.		*Tail lamp, Solar

ABBREVIATIONS—Make of lamp: Adams-Bagnall, Ad.-Bag.; Bryan-Marsh, Br.-Marsh; Edmunds & Jones, E. & Jones, Ed. & Jones; Gray & Davis, Gray & D, Gray & Da.; General Electric, Gen. Elec.; McCandless, McCandls. **Type of socket:** Ediswan double contact, Edswn D; Ediswan single contact, Edswn S; Candelabra, candel. **Dimmer:** Resistance, Resist.



excess pressure. The voltage of the Ford lamps is therefore 8, although the nominal rating of the ignition system voltage is 6.

Advantages of Single Wire

The advantages of the single wiring system in the saving of wire and simplicity have made themselves felt among American manufacturers and the time is rapidly approaching when an attempt to secure at least an official recommended practice on the part of the S. A. E. will not be met by the strenuous opposition which was the case at the recent meetings of the society. It is to be regretted that there is such a wide variation in the candlepower, voltage and ampere ratings of the lamps now used on different makes of cars which have electric systems of the same characteristics in other particulars. The sockets most often used are shown in the accomtems, has given ground to the Ediswan double contact type A, which was the most popular in the day of two-point systems has given ground to the Ediswan single point type shown at B. The new Bosch types are shown at C for headlights and C1 for side and tail styles. The latter are familiarly known as the cartridge type. D is the candelabra design to which frequent reference is made in the accompanying table and E is the miniature which is employed for speedometer lights and similar purposes.

Car	HEADLAMPS			SIDE LAMPS			TAIL LAMP			DASH LAMP			Make of Lamp	Socket	Wiring	Dimmer	Method of Focusing	Remarks
	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.						
Knox	6	...	15	6	...	4	3	...	2	3	...	2	Hall	Edswn D.	Double			
Lambert	6	...	16&24	6	...	4	6	...	2	6	...	2	*	Edswn D.	Single	Series	Focusing base	*Dash lamp, Guide; others Victor and Indiana
Lewis, VI	6	2.5	15	6	.84	4	6	.42	2	6	.42	2	Ad.-Bag.	Edswn D.	Single		Adj. socket	
Lex-Howard	6	2	16	...	...	...	6	.5	4	6	.5	4	Indiana*	Edswn S.	Single	Resist.	Adj. socket	*Dash lamp, Culver-Stearns double contact
Locomobile	7	3	21	7	.53	3	7	.53	3	7	.36	2	Br.-Marsh	Edswn S.	Single	Resist.	Adj. socket	
Lyons-Knight	7	3.5	24	7	.6	4	7	.5	3	7	.5	4	E.&Jones.*	Edswn D.	Double			*Tail lamp, Badger
McFarlan	6	4	24	...	...	...	6	.75	4	6	.75	4	Indiana	Edswn S.	Single	Resist.		
Marmon	12	...	25	12	1.5	8	12	1.5	8	12	...	8	Bosch	Bosch	Single	Resist.		
Maxwell	7	2.25	15	4.6	1.5	6	7	.5	2	...	...	...	Ed.&Jones.	Edswn S.	Single	Resist.	Ratchet socket	
Mercer	12	...	18	12	...	4	12	...	4	12	...	4	Badger	Edswn S.	Single			
Metz	6	2.5	15	6	.84	4	6	.42	2	...	...	...	Gray&Da.	Edswn S.	Single			
Mitchell	7	2.4	15	...	...	...	7	.42	2	7	.42	2	*	Edswn D.	Double	Series	Sliding socket	*Head and tail lamps, Brown; side lamps, Adams-Bagnall; dash lamp, Culver-Stearns
Moline-Knight	6	...	18	6	...	4	6	...	4	6	...	4	Gray&Da.	Edswn D.	Double	Series	Adj. socket	
Monarch	6	...	16	...	...	...	6	...	2	6	...	2	Victor	Edswn D.	Double		Adj. socket	
Moon	7	...	15	7	3	15	7	...	2	7	...	2	Ad.-Bag.*	Edswn D	Single	Resist		*Tail lamp, Rose
Moyer	7	4	24	7	.84	4	7	.42	2	7	.42	2	Ed.&Jones.	Edswn D.	Double			
National	6	2.5	15	6	.75	6	6	.5	4	6	.35	2	Badger	Edswn D.	Double		Ratchet socket	
Oakland	7	2.5	15	...	...	...	7	.5	2	7	.5	2	*	Edswn S.	Single	Resist	Sliding bulb	*Headlamps, Model 49, and all lamps Model 37 E&J; tail lamp, Model 49, Rose; dash lamp, all models, Post Glover
Oldsmobile, 6	7	...	21	...	...	...	7	...	4	7	...	4	Corcoran	Edswn S.	Single	Resist		
4	7	...	21	...	...	...	7	...	4	7	...	4	Corcoran	Edswn S.	Single	Resist	Adj. socket	
Overland	6	2.5	16	6	.84	4	3	.42	2	3	.42	2	Auto-Lite	Edswn S.	Single			
Packard	6.4	4.5	29	7	.84	4	7	.42	2	7	.84	4	Packard	Edswn D.	Double		Screw adj.	
Paige	6	2.5	15	6	.75	4	6	.4	2	6	.4	2	Gray&Da.	Edswn S*.	Single		Screw adj.	*Dash lamp, double
Peerless	6.5	2.5	15	7	.84	4	7	.42	2	7	.42	2	Guide*	Edswn S.	Single			*Dash lamp, Vesta
Pierce-Arrow	7	2.5	21	...	...	...	6	1.5	4	6	1.5	4	Howard	Edswn S.	Single	Resist.	Adj. bulb	
Pilot	6	...	15	6	...	5	6	2.5	2	...	...	...	Badger	Edswn D.	Single	Resist.	Adj. socket	
Pathfinder	6	2.5	16	6	1	4	6	1	2	6	...	4	Hall	Edswn S.	Single			
Pratt	6	2	21	6	2	6	6	1	6	6	1	4	Gray&Da.	Edswn S.	Single		Adj. socket	
Pullman	12	...	16	12	2.5	8	12	1	2	...	...	...	B&L	Edswn D.	Double	Series	Adj. socket	
R-C-H	6	3	16	6	1	4	6	.5	2	...	...	...	Hall	Candel	Double*		Adj. socket	*Tail lamp single
Regal	6	...	21	6	...	...	6	...	2	6	...	2	Hall	Edswn D*	Single	Series	Adj. bulb	*Tail lamp single
Remington	12	1	12	...	...	...	12	.25	2	...	...	...		Edswn S.	Double	Series	Screw adj.	
Reo	6.5	2.5	15	...	1.25	...	3.5	1	4	3.5	1	4	Corcoran*	Edswn D.	Double	Resist†	Screw adj.	*Dash, Brown † on S; series on R.
Republic	6	3	15	6	1	6	6	1	4	6	75	2	Gray&Da.	Edswn D.	Double			
Saxon	6	...	15	...	...	...	6	...	2	6	...	2	Gray&Da.	Edswn S.	Single	Resist.	Adj. socket	
Scripps-Booth	14	1	15	14	.42	4	14	.26	2	14	.26	2	Hall	Edswn S*.			Adj. bulb	*Dash lamp double
Simplex	6	4	24	6	1	4-6	3.5	.5	2	3.5	.5	2	Gray&Da.	Edswn S*.	Single			*Dash and tail lamps, double
Singer	6	...	21	6	.5	6	6	.5	2	6	.5	2	Badger	Edswn S.	Single			
Speedwell	6	3	20	6	1	6	6	.5	2	6	.5	2	Ed.&Jones.	Edswn D.	Single			
Sphinx	6	2	12	6	.33	2	6	.33	2	...	...	...	Guide	Edswn S.	Single		Adj. socket	
Spaulding	21	...	21	21	.19	4	21	.09	2	21	.09	2	Ad.-Bag.	Edswn D.	Double		Adj. socket	
Stearns	6	...	15	6	...	3	6	...	2	6	...	2	Guide*	Edswn S.	Single		Adj. bulb	*Big 4 & Six, Gray & Da.
Stevens-Duryea	7	...	21	7	...	4	7	...	4	7	...	2	McCandls.	Edswn S.	Single	Resist.	Adj. bulb	
Studebaker	7	2.45	16	3.5	1.25	...	7	.45	2	7	.45	2	Hall	Edswn D.	Double	Series	Adj. bulb	
Stutz	7	3	15	7	.5	4	7	.4	2	7	.4	2	Badger	Edswn D.	Double			
Trumbull	6	1	6	6	1	2	6	5	1	...	...	...	Hawthorne	Edswn D.	Double	Series	Adj. socket	
Velie	6	2.5	15	6	.8	4	3	.4	2	3	.4	2	Badger	Edswn S*.	Single			*Dash lamp, double
Westcott	7	2.5	18	3.5	...	9	3.5	1	2	3.5	1	2	E.&Jones.*	Edswn S.	Single	Resist.	Sliding socket	*Tail lamp, Hall; dash lamp, Culver-Stearns
White	21	1	21	21	.3	4	21	.15	2	21	.3	4	Hall	Edswn D.	Double			
Winton	6.4	2.5	15	7	.84	4	7	.42	2	7	.42	2	Gray&Da.	Edswn S.	Single		Screw adj.	
Zimmerman	6	...	16	6	...	4	6	...	2	6	...	2	Badger	Edswn D.	Double		Adj. reflector	

ABBREVIATIONS—Make of lamp: Adams-Bagnall, Ad.-Bag.; Bryan-Marsh, Br.-Marsh; Edmunds & Jones, E. & Jones, Ed. & Jones; Gray & Davis, Gray & D, Gray & Da.; General Electric, Gen. Elec.; McCandless, McCandls. **Type of socket:** Ediswan double contact, Edswn D; Ediswan single contact, Edswn S; Candelabra, candel. **Dimmer:** Resistance, Resist.

Uses of Formula for Dynamic Flexibility as Guide to Best Spring Results

(The Improvement of Spring Systems—XI)

By M. C. K.

THE expression for "dynamic flexibility," $DF = nL : (10 \pm m)$, it was suggested in article X where the term was developed from the formula for the period of oscillation, may be used for describing in one breath the properties of a half-elliptic automobile spring, by inserting the values for n and m which the spring dimensions determine. It was understood that the numerical value of DF (which is a symbol for the suggested term, "dynamic flexibility," but not a product of D and F) is the same as that of F, which is the inverse of f, the coefficient of flexibility, $(Ff = 1)$, and that the value of nL equals that of P, which is the maximum permissible load of the spring or, in practice, the load for which the spring should be dimensioned to continue to work within its elastic limit and with deflections pro rata with loads; also that L is the static load which the spring is actually to carry.

Clash with Practice

The P which would most rationally be chosen for determining the spring dimensions would equal the static load producing the utmost permissible deflection of the spring in the use of the vehicle, but in practice the course has been followed of modifying the meaning of the formulas by which the spring dimensions are determined from a given P, or obversely, with the result that P has become nominally the same as the actual static load L multiplied by a small factor of safety ranging from 1 1-2 to 2, and this practice seems to have influenced spring design, by making it appear as if a suitable automobile spring could be calculated from its static-load figure and the desired flexibility, without reference to the large working capacity required of a spring at high vehicle speeds. According to these methods P becomes rated too low for any given spring, and if this P is used in the formula for the period of oscillation, T, the value found for T is smaller than that really obtained from the spring. And the friction of spring leaves also increases T in practice, so that the discrepancy between the period by formula and that of reality becomes pronounced. But this can be obviated by establishing a sharp distinction between P and L, choosing P according to the severity of the work and returning to actual, instead of doctored, figures for S (tensile strength) in the American formula for P (spring strength) and for k_b (maximum bending stress) in the corresponding German formula. In both cases the modified figures were adopted to get springs from the old formulas which would be strong enough for automobiles—as further referred to in another column—but for looking into the subject with a view to improved practice it is of course necessary to go back to the principles, and these require that an automobile spring should be calculated for a much higher load capacity P (namely, for the static equivalent of the maximum shock) than that indicated by its static load. In the expression for DF it is the factor n whose numerical value should indicate the severity of the work for which the spring is intended, since $nL = P$.

If a spring is so dimensioned as to be characterized by $DF = 3 \times L : (10 + 3)$, the following properties are thereby made known: It is intended for a load of 1,000 pounds; it is figured for a safe load P of 3,000 pounds; its flexibility is $F = 3{,}000 : 13 = 231$ pounds to cause a deflection of 1 inch, or $f = 1 : F = 0.00433$ inch, being 0.433 inch deflection for each 100 pounds of load; its theoretical period of oscillation would be 120 to the minute if the divisor were 10 instead of $10 + 3$, and it is lengthened somewhat in this proportion, making perhaps 100 oscillations per minute subject to further lengthening by friction. More accurately, by applying formula for the period of oscillation,

$$T = \pi \sqrt{\frac{P \cdot f}{g}}, \text{ in which } P = 3{,}000 \text{ and } f = 0.00433 : 12$$

one finds T to be about 0.57 second, corresponding to 105 oscillations per minute. How much this would be reduced by the friction of spring leaves and vehicle parts, or by a spring damper, would depend on the details in these elements. If a coefficient of friction of 20 per cent. could be assumed the practical length of period T might be found directly by introducing it in the formula, making this

$$T = \pi \sqrt{\frac{P \cdot f}{g\ (1 - 0.20)}} = \pi \sqrt{\frac{3{,}000 \times 0.00433}{12 \times g\ (1 - 0.20)}}$$

It is further known that a spring whose $DF = 3 \times 1{,}000 : 13$ will be deflected 4.33 inches from molecular equilibrium under its actual load of 1,000 pounds and will have a range of action within its capacity of 8.67 inches additionally.

Providing Accessories in Advance

While this manner of describing spring properties depends for accuracy upon using a formula for P in which there are no fictitious values, it is perhaps clear that the general use of this mode of description would soon develop empiric rules for the selection of springs for different classes of vehicles. It might become recognized that a fast car's spring suspension should be made to correspond to $DF = 2L : 20$, that of a delivery wagon to $4L : 15$, that of a truck to $3L : 10$. and when it was found that springs corresponding in their dimensions to the desirable equation, in each case, would be of inconvenient size and that it would be necessary to use springs of different dimensions, the problem would be squarely put of supplementing such springs with devices calculated to bring the factors n and m, in which P and F are implied, into conformity with the requirements—in addition to what other useful function such devices might perform.

Helping the Designer

In any practical instance, when it might be desired to use the DF formula for finding out, independently of previous practice, what condition should be materialized in the spring system of a vehicle whose working conditions are known, P could be decided upon from the known L and the desired flexibility, in conjunction with knowledge of the maximum deflection for which it is possible to provide in the vehicle. As spring dampers can always serve to lengthen the period of oscillation and to strengthen a spring against shock, a suitable compromise of the figures can always be arrived at by shaving n and $10 \pm m$ to relatively low values, provided

it is not static overloads which are mainly to be feared. These call absolutely for a large n and large range of action, or else for springs of progressive resistance.

It was understood that tests might show another figure than 10 best adapted for expressing the most desirable theoretical period of oscillation (meaning by "theoretical" a period which will be lengthened in practice by friction), but if such a modification should be found advisable, the formula would undergo no other change than one relating to the understanding of its meaning. The new figure, be it 11 or 12 or 9, would simply be the one to be aimed for, the one which the spring dimensions should express, or which should be realized by the combination of the spring and auxiliary devices.

Revising Old Formulas

In now comparing the requirements expressed in the formula with their realization in the spring dimensions, it is necessary to see that the dimensions produce the correct P and the correct F with the use of the formula $P = Z \cdot 4Nbt^2 \div 6l$, in which Z is a factor which is usually termed S and is taken as identical with the tensile strength of the spring material, hardened, but which probably should be taken at a somewhat lower value where alloy steels, for springs, are concerned; a suitable figure for each of the standard spring steels is yet to be ascertained by tests. The other formula to be used, and in which the variables, b, t and l, have to be brought to the same values as they hold in the P formula, is that for flexibility, usually $F_1 = Sl^2 \div 4Et$, where F is the deflection caused by P and in which the Z value found suitable for the P formula should take the place of S. Whether the modulus of elasticity of the material, E, should also be changed for alloy steels may be open to questioning.

As one has $F_1 : P = 1 : F$ or $F = P : F_1$, it is seen that the value of F in the DF expression becomes $(Z4Nbt^2 \cdot 4Et) \div (6l \cdot Zl^2) = (16Nbt^3 \cdot E) \div 6l^3$, in which Z is eliminated; as it should be, since simple flexibility is determined independently of the strength.

From these formulas with a Z value only slightly smaller than the known tensile strength of the spring material—whose tensile strength thus must be known to the automobile manufacturer if he shall be able to judge by this method of the product furnished him by the spring maker—it should be possible to form an idea in advance of how near to a suitable spring suspension it is possible to get for a given vehicle design with simple half-elliptic springs and to what extent it should be necessary to supplement such springs with other devices or to change to springs of a different type.

Unaided Half-Elliptics Doomed

As in practice half-elliptic springs made to take care of their loads properly at high speeds on uncertain roads are much longer and heavier than it is desirable to have them, in consideration of other factors in vehicle design, one of the most practical uses for the DF formula should be that of determining the nature of the means most suitable in each case for getting good work from springs which are not in themselves suitable but fit the design and the popular expectations of the appearance of springs. As a rule such springs are both too stiff and too weak; their DF is small because n is small. They have not been made for a P sufficiently much larger than the actual static load. They can even then have the right period of oscillation—which however is the feature which if wrong can be most easily corrected by dampers—but the n value will show that they will not be safe springs for taking care of large oscillations, and least so on the rebound. In springs which are both weak and stiff, both n *and* $10 \pm m$ are reduced in value, and the arithmetical value of DF therefore remains unchanged, as it must do, since arithmetically DF means only simple flexibility, while it shows the working capacity of a spring and its period of oscillation when its component factors are looked into separately and in their mutual relations.

In the case of C-springs and platform springs it is evidently possible to figure with them as spring units producing a single P and a single F, though with some complications which it would be too lengthy to enter upon here, but with regard to their periods of oscillation, the element enters that the quarter-elliptic and the transverse springs may be made to have a different action from that of the half-elliptic, with the purpose of breaking up the periods and perhaps accomplishing greater comfort in this manner for certain road conditions. It may even then be assumed that for normal travelling the average period of the different spring elements should come close to the same figure which spells one condition for comfort with plain half-elliptic springs.

For cantilever springs, on the other hand, a different DF formula should be developed, but it is the object here only to indicate in a general way a method for designating spring properties which, it seems, could be followed up, and which has been lacking in the past, the need for it having become urgent only in the case of automobile springs, of which so much is asked while the limitations of weight and dimensions are drawn much more sharply than in any other line where springs are employed.

Temporizing Methods

The difference in the German and the American methods in calculating springs throws some light on the indefiniteness in both proceedings, arising no doubt in both instances from the need of keeping the formulas open to practical modification so long as spring steels and automobile requirements were continually undergoing changes whose end could not be seen. But these methods of patching the formulas up with concessions have kept spring mechanics outside of the public ken and made figuring with spring problems difficult.

The manner in which the old formula for safe spring load, with S for the tensile strength of the material as a factor, has here been made to answer has been developed by balancing the new and severe requirements made of springs in automobiles against the new and better spring steel properties which steel makers have learned to turn out. By taking 80,000 pounds to 100,000 pounds for S, while using steel whose tensile strength runs up to at least 150,000 pounds in the hardened condition, the nominal value of P has been kept down while the actual carrying capacity of a spring with given dimensions has been brought nearer to the automobile demands, as these were developed in practice.

One Compromise Accusing the Other

But the allowance thus made still does not compare with that made in German tables of k_b values, which are given in three classes, among which the third one is applicable to automobile springs and gives figures which represent only about one-third of the full static maximum bending stresses of the materials. Figuring with these tables the Germans should thus get P even closer to L than is done here, and it may perhaps be assumed that on this basis they may be able to get along with fewer approximations at other points. As however no superiority in the spring equipment of German automobiles is observed in practice—all relying on dampers and auxiliary springs—the true demand is for a sharp distinction between P and L values rather than for compromises which merge them.

Speaking Terms Wanted

In this respect it seems to the writer that, if the DF formula were developed to finality by experimentally getting a good value for Z and another for the desirable period of oscillation—which is here provisionally figured as expressed by the divisor 10—much would have been done for getting on speaking terms with spring properties in their relations to automobile requirements.

341,250 Motor Vehicles in United Kingdom

136,000 Are Privately-Owned Automobiles—132,000 Motorcycles—4,500 Buses —36,500 Cabs—Of 32,250 Commercial Vehicles, 11,700 Gasoline and 3,500 Steam Trucks Are of 2 Tons Capacity

LONDON, ENGLAND, April 2—There are 341,250 motor vehicles of various descriptions in use in the United Kingdom, according to an estimate given out recently by the secretary of the Good Roads Board. Of these machines, approximately 136,000 are privately-owned automobiles, 132,000 are motorcycles, 4,500 are omnibuses, 36,500 are cabs and the remaining 32,250 are motor trucks of various types and styles. For example, there are 11,700 gasoline machines of over 2 tons capacity and 3,500 steam vehicles in the same class, while of the 17,050 commercial cars having capacities under 2 tons, 14,000 are of four-wheel construction and 3,050 are three-wheel types.

Many Motorcycles

It is specially interesting to note that the motorcycles in each one of the divisions of Great Britain are nearly equal in number to the privately-owned automobiles. For example, in England and Wales there are 118,000 motorcycles as compared with 120,000 automobiles while in Scotland the total of 12,000 motorcycles comes correspondingly close to 12,500 of the larger vehicles. In Ireland there is a difference of 1,000 there being 3,500 privately-owned cars and 2,500 motorcycles. The causes responsible for this condition of affairs are mainly to be found in the high cost of living in these countries as compared with the United States where the number of motorcycles is in much smaller proportion to the number of automobiles. Another factor in favor of the motorcycle is the shortness and excellent surface of roads in Great Britain which render this type of vehicle especially satisfactory for service in these countries.

England and Wales, considered together, lead Scotland and Ireland in every particular, the total statistics for England and Wales being 300,750 vehicles as compared with 33,850 for Scotland and 7,150 for Ireland.

England and Wales Lead

Analyzing the total statistics into the component units by country we find that England and Wales have 120,000 automobiles as compared with 12,500 for Scotland, and 3,500 for Ireland. The percentage of motorcycles is overwhelmingly in favor of England and Wales, their 118,000 making a formidable showing against the 12,000 for Scotland and 2,500 recorded for Ireland. In the omnibus field the same conditions prevail, the leading countries having 4,000 as compared with 400 in Scotland and 100 in Ireland. The 31,000 motor cabs in England and Wales compare with 5,000 for Scotland and 500 for the Emerald Isle.

Map of United Kingdom, showing number of cars, motorcycles and trucks

Analyzing Truck Statistics

Comparison of the statistics in the commercial vehicle field reflect those found in the passenger vehicle class, England and Wales having 10,000 gasoline trucks of over 2 tons capacity while Scotland has 1,500 and Ireland 200. Steam vehicles in lesser proportion keep approximately the same ratio, those over 2 tons capacity numbering 3,250 for England and Wales while Scotland has but 200 and Ireland only fifty.

England and Wales, the leading countries have 12,000 four-wheelers while Scotland has 1,750 and Ireland but 250. Three-wheelers are used in England and Wales to the extent of 2,500 whereas in Scotland there are 500 of these machines as compared with fifty in Ireland.

Estimate of Motor Vehicles in Use in the United Kingdom in February, 1915, Excluding Those Sent to the Continent for Army Use

Class of Vehicles	England and Wales	Scotland	Ireland	United Kingdom
Automobiles	120,000	12,500	3,500	136,000
Motorcycles	118,000	12,000	2,500	132,000
Omnibuses	4,000	400	100	4,500
Cabs	31,000	5,000	500	36,500
MOTOR TRUCKS OVER 2 TONS CAPACITY				
(a) Gasoline	10,000	1,500	200	11,700
(b) Steam	3,250	200	50	3,500
TRUCKS UNDER 2 TONS CAPACITY				
Four Wheels	12,000	1,750	250	14,000
Three Wheels	2,500	500	50	3,050
Totals	300,750	33,850	7,150	341,250

N. S. W. Cars Increase 2,360 in 1914

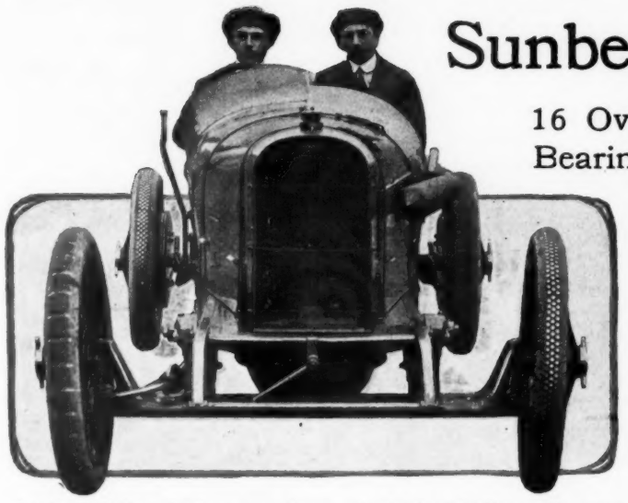
SYDNEY, AUSTRALIA, March 15—The total number of automobiles in New South Wales in 1914 was 10,001 as compared with 7,641 in 1913, according to statistics compiled by the Motor Traders' Assn. of N. S. W. Since May, 1914, the number of privately owned automobiles has increased from 8,615, while commercial vehicles have increased from 497 to 585. Taxicabs numbered 236 as compared in May, 1914, to 238.

New registrations in 1914 for automobiles amounted to 3,293 and for commercial vehicles, 229. Licenses given to automobile drivers amounted to 5,597. The total number of licensed drivers in 1914 was 16,058, of which 377 were taxicab. Complete statistics follow:

New Registrations for 1914	
Cars	3,293
Commercial vehicles	229
Motorcycles	3,147
New Licenses for 1914	
Drivers	5,597
Motorcycle riders	3,550
Motor Vehicles	
Cars	10,001
Commercial vehicles	585
Motorcycles	6,373
Taxicabs	236
Drivers Registered	
Cars	16,058
Motorcycles	8,095
Taxicabs	377

Sunbeams for Indianapolis

16 Overhead Valves — Two-Piece Ball Bearing Crankshaft—Special Steel Piston



Louis Coatalen, Sunbeam engineer, at wheel of Indianapolis racer

THE two Sunbeam cars which will compete in this year's 500-mile contest at the Indianapolis speedway on May 29 will be similar in general design to the cars built by this company for the French Grand Prix at Lyons last July. The four-cylinder motor has a bore of 3.7 inches and stroke of 6.2 inches, giving 271 cubic inches piston displacement, or well under 300, and is of the extremely high-speed type. There are two camshafts arranged right over the valves, which are located directly in the cylinder heads; no rockers are used, but the cams operate the valves through short, straight push rods of extreme lightness. To each cylinder there are four valves, and they are so light that springs of only moderate strength are required, this being in strong contrast to the heavy springs that would be necessary for a pair of valves giving the same area of opening as the four small ones. The camshafts are driven by a train of spur gears contained in a case on the front end of the cylinder block, ball bearings being used to simplify the lubrication.

Two-Piece Crankshaft

For the crankshaft ball bearings are used also, and the shaft is made in two halves to permit the easy mounting of the center bearing. Lubrication of these bearings is easy, of course, and the only points requiring special care in this respect are the connecting-rods. For taking oil to these under some pressure a ring is attached to each crank web and oil is squirted into the channel thus created. From one side of the ring a hole is drilled through the crankpin so lubricant is delivered to the bush by centrifugal force. The pressure induced when the motor is running fast is quite considerable. The oil is fed by air pressure from a dashboard tank and returned thereto by a pump which keeps the crankcase always empty.

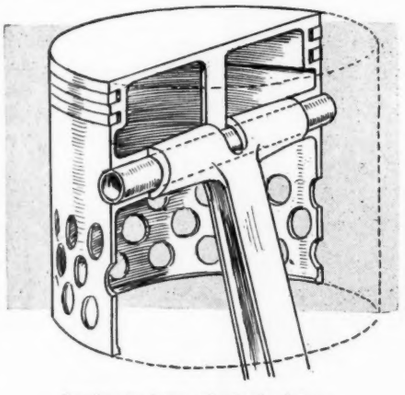
The type of piston favored by the Sunbeam engineer is shown in the drawing and it is made entirely of steel. In the center of the head a "leg" is inserted, the lower extremity resting upon the center of the piston pin, the idea of this being to carry off heat from the piston head as well as to support it.

In the chassis there are no departures from standard Sunbeam practice. The clutch is a cone, faced with woven fabric, the gearset provides four speeds and the rear axle is bevel driven. There is a differential, as experiment on the track and on the road has shown that the solid type of rear axle is dangerous to the driver if a rear tire should deflate. The springs take the drive and are half elliptic, and very long, the brakes being in accordance with European practice—one on the transmission and a pair of expanding.

Last year's cars showed a maximum of about 110 miles an hour on Brooklands track and no doubt this will be at least equalled in the new racers.

Porporato to Drive

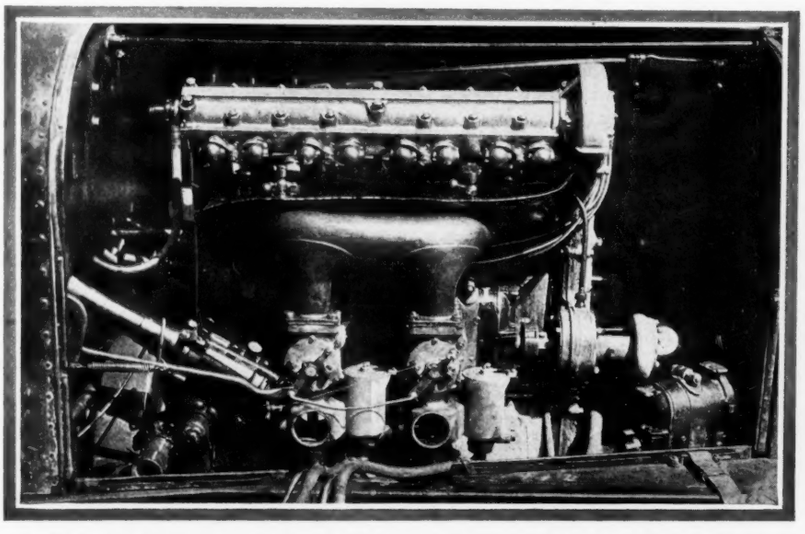
J. Porporato will drive one of the cars and is now at Brooklands preparing his car for the 500-mile race. There is a possibility of Jean Chassagne being released from military service in France to drive the other machine. Other candidates for the second car are Arthur Duray, Mathis and Hornstead.



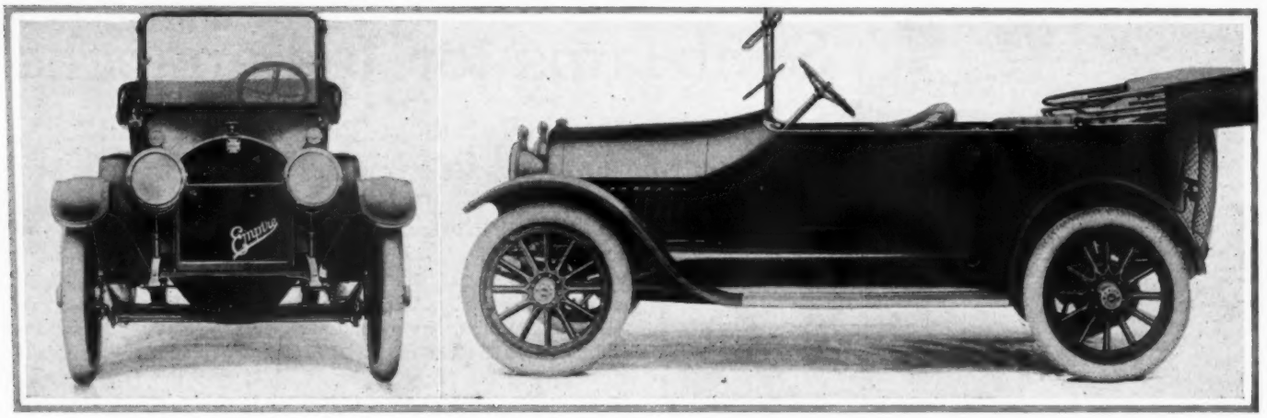
Sunbeam type of steel piston

—

PARIS, April 2—Rene Thomas, winner of the Indianapolis 500-mile race last year, has secured an option for the purchase of the Delage grand prix racers. One of the Peugeot 1914 Grand Prix racers built under the 300 cubic inches piston displacement rule has been shipped to the New York branch. This machine, which is doubtless intended for Dario Resta, is the only 1914 Peugeot which has left the factory.



Intake side of Sunbeam motor for Indianapolis race. Note duplex carbureters



Left—Front of Empire for 1916. Right—Side view of touring car. Note mounting of small lamps on headlights in both views

1916 Empire—Larger High-Speed Motor

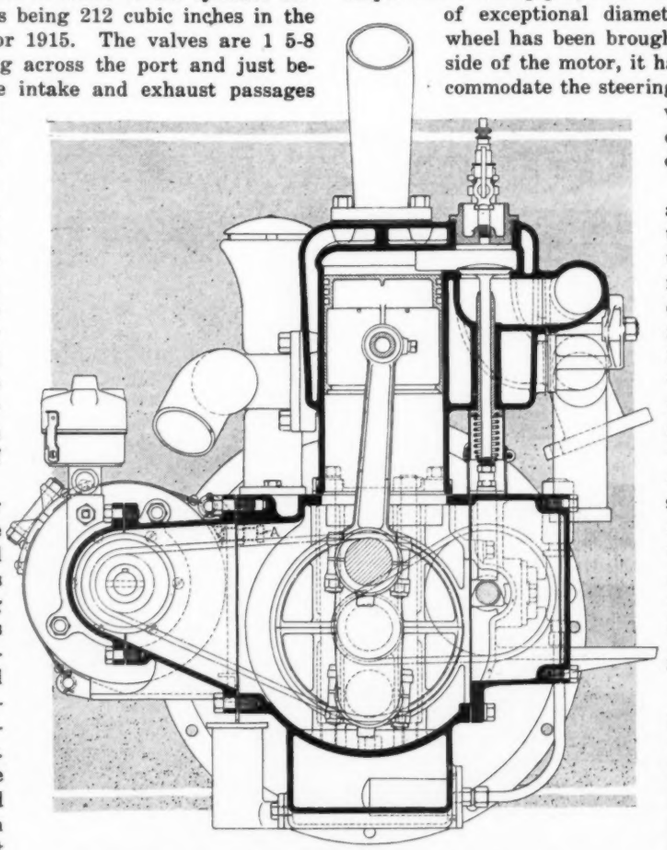
Various Detail Refinements But No Radical Alterations From 1915 Model—Main Features Continued

MOST conspicuous of the changes in the Empire car for 1916 is in the motor which now has an increased bore, this being 3 7-8 inches as against 3 3-4 inches. There is no change in the stroke which remains 4 1-2 inches, but the larger bore adds 14 cubic inches to the cylinder displacement, the actual volumes being 212 cubic inches in the new model as against 198 for 1915. The valves are 1 5-8 inches in diameter, measuring across the port and just beneath the valve head, so the intake and exhaust passages have each a cross sectional area of over 2 square inches. The peak of the horsepower curve is reached at 2,200 r.p.m. and at this speed the gas velocity through the valve port will be a trifle over 165 feet per second, which is distinctly on the low side. This low velocity means that the cylinder will get a full charge up to quite high speeds and accounts for the high power peak, which is also assisted by the use of light reciprocating parts.

A peculiarity of the motor is the great length of the valve guide, which should guard against air leaks when the car has seen long service. The valve springs are small and readily accessible, while they are inclosed separately in brass cases instead of being behind a common plate covering all eight.

It may be seen in the drawing on this page, and also in the photographs on page 681, that the camshaft is contained in a side plate which also holds the push rods, so the whole of the valve-operating mechanism is detachable from the crankcase of the motor. A separate plate gives access to the chain which is used for driving the camshaft.

Another point to be observed in the photographs is the ample size of the pipes, both water and gas manifolds being of exceptional diameter. Although the steering wheel has been brought from the right to the left side of the motor, it has been found possible to accommodate the steering gear without rendering the valves difficult to reach, as can be seen in the chassis drawings, page 682.



End section through 1916 Empire motor, showing how entire valve-operating mechanism is detachable as the camshaft is contained in a side plate which also holds the push rods. A separate plate covers the camshaft driving chain

Lubrication is cared for by a plunger pump driven off the camshaft, and located at the rear end thereof. This maintains the level of oil in dip troughs beneath the connecting-rods, by sending lubricant to sight feeds on the dashboard, whence it passes to the main crankshaft bearings and overflows to the gutters. It should be observed that the filtering screen is easy to remove for cleaning, and the oil pump too, can be taken off very readily in the unlikely event of the necessity to clean or inspect it.

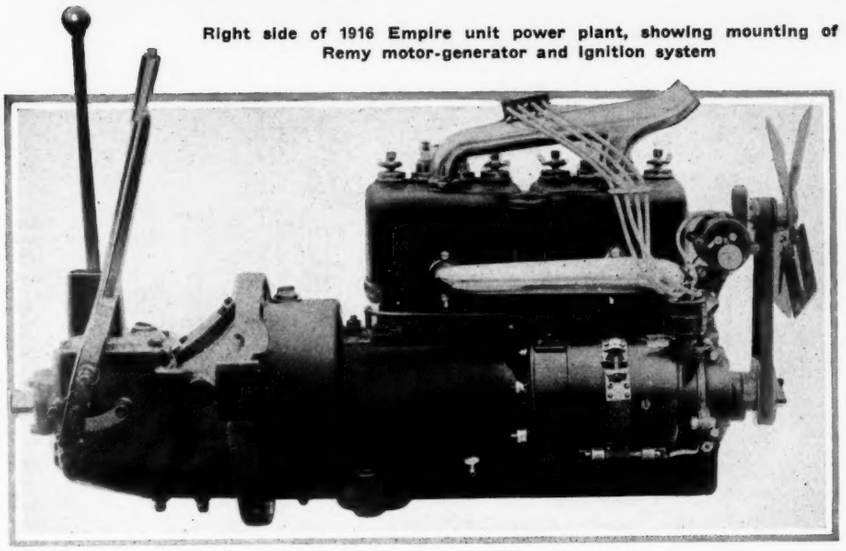
Single-Unit Starter

For ignition, starting and lighting a Remy single unit apparatus is used, this following the practice of last year, and it may be supposed that this continuance shows that the Remy outfit has proved itself well capable of maintaining satisfactory performance. The gear ratio of

the motor-generator with the crankshaft is approximately three to one and the maximum armature speed is therefore fairly high; it must rise to 8,000 r.p.m. when the motor is turning at its maximum.

Needless to say, the momentum of the armature at such high speeds is considerable and a sudden shutting off of the motor will cause the energy stored in the armature to be delivered to the crankshaft flywheel fashion. This means that the chain which connects the two parts is liable to have stresses in alternating directions imposed upon it, and when a chain is used under such conditions its life is lengthened when the tension is maintained at a degree sufficient to prevent the slack side from developing sufficient looseness to permit "thrashing." In order to make it easy for any owner to care for this, the electrical machine is mounted on a rocking base. Again turning to the section of the motor, it can be seen that the motor-generator rests on a platform and is gripped thereto by a spring steel band and clamping bolt. This band draws the machine down upon the platform and also pulls it against the side of the crankcase where it encounters the end of the adjusting bolt A. With the band clip slacked off, the chain can be tensioned by turning the bolt A which has a lock nut to fix it when the right position is found.

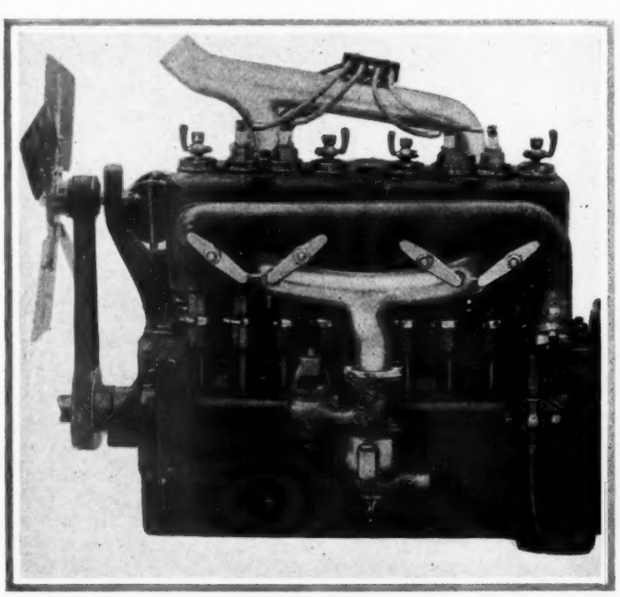
Right side of 1916 Empire unit power plant, showing mounting of Remy motor-generator and ignition system



Single Plate Clutch

For the clutch a single plate pattern is used the spring pressure being applied through a system of multiplying levers that give the desired degree of thrust without the need for a heavy clutch pedal action. The flywheel spigot is a ball bearing and the revolving part of the clutch could scarcely be made lighter, so it is to be assumed that the operation of changing gear is extremely easy. It is usually found that ease of gear shifting varies almost directly with the weight of the clutch, though this is not a universal law.

Three forward speeds are provided by the gearset which bolts directly to the crankcase and the clutch is inclosed completely and runs in oil. It may be mentioned that the clutch surfaces are alternate steel and fabric, which is rather uncommon in a lubricated clutch, but it ought to prevent the tendency to stick which is sometimes found in metal-to-metal clutches when the oil is cold.



Left side of Empire motor, showing mounting of carbureter, arrangement of manifolds and accessibility of valves

The gear ratios are thirteen, eight and four to one respectively, but the reverse is extra low, being no less than sixteen to one. The rear axle is of Weston-Mott construction, having a finger nut adjustment for the service brake bands, which is accessible very readily by merely putting a hand between the spokes of the rear wheel. Thus the brakes can be taken up in a few moments and without the use of any tools.

To support the driveshafts in the axle, Hyatt heavy-duty bearings are employed, and a New Departure double row is situated behind the differential to support the thrust from the plain type bevel gear.

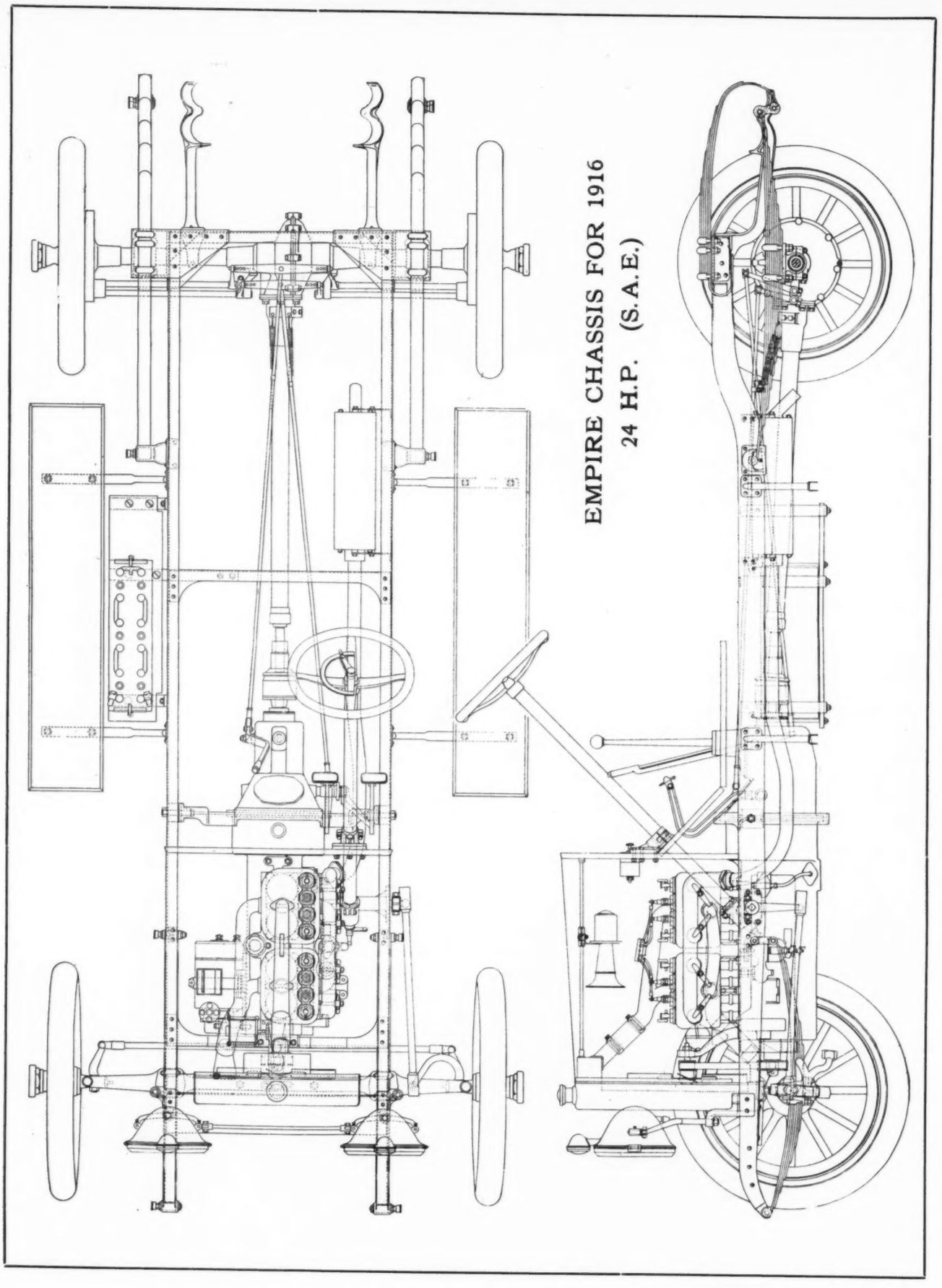
Brakes Are Special Feature

Shown in the chassis drawings and also—to a larger scale—in a separate illustration, is the equalizing mechanism for the brakes which has been cared for particularly. From the pedal and from the emergency lever are a pair of straight rods running direct to the centers of balance beams on the axle. The latter are sufficiently long to give real compensation and there is plenty of surface on the extremities which enter the final brake levers. The levers themselves are also on the long side, so rapid, easy action and plenty of power should be characteristics of this brake system.

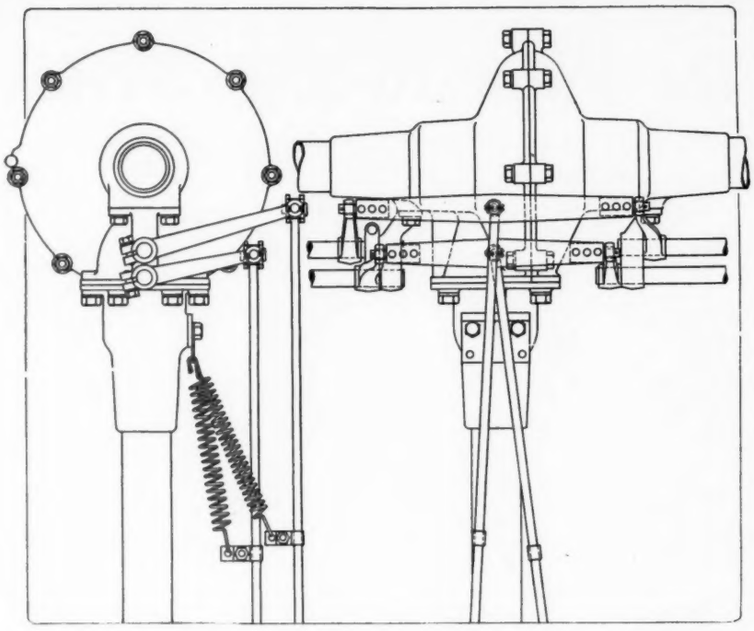
Three-Unit Assembly Method

Assembly of the chassis is carried out on a three-unit system. Frame, springs and front axle make one unit; the power plant with the steering gear and pedals makes the second, while the rear axle is the third. For the power plant there is a bearer on the front cross member of the frame, and two points of attachment to the side rails, these being in line with the clutch casing. At these points are two bolts only, one on each side, and a couple more attach the outboard end of the steering gear. Thus it is easy to see that the power plant goes into the frame with very little trouble in fitting. Attachment of the rear axle and the connection of the driveshaft present no special points, but there are very few bolts to be inserted in order to make a complete chassis from the three main components.

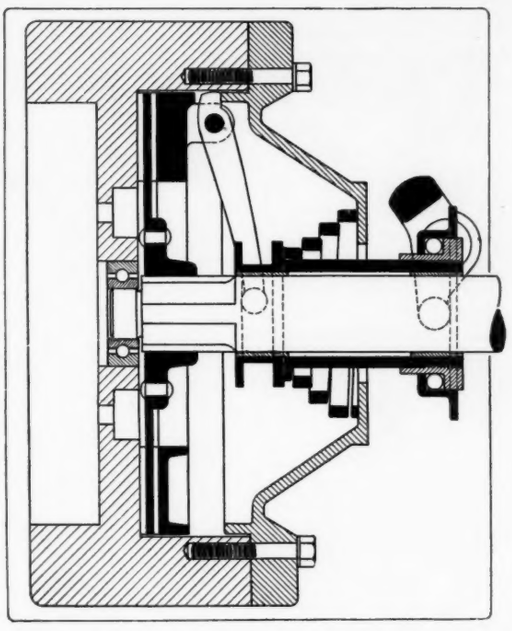
Two minor points that are noteworthy are the location of the battery in a place where it can be inclosed completely and yet be readily accessible, and the strong construction of



EMPIRE CHASSIS FOR 1916
24 H.P. (S.A.E.)



Detail of brake equalizing mechanism on the 1916 Empire, a feature of the design of this chassis. The two straight brake rods run to the centers of long balance beams on the axle and there is plenty of surface on the extremities which enter the final brake levers



Section through the single-plate clutch used on the 1916 Empire, showing one of the systems of multiplying levers. The clutch surfaces are alternate steel and fabric

the corner plates which attach the rear springs to the frame; both these features can be seen in the chassis views, page 682.

Few Changes in Body

In the bodywork there has not been much change. An increase in wheelbase from 108 to 112 inches allows more room in the tonneau and the smooth lines of the body are improved a little by the slight addition to the length overall. The body equipment is on standard lines, with a one person top and quick action curtains.

Stanweld demountable rims are now standard fittings, together with a Stewart speedometer and the usual kit of small things, but the lamps are distinctive and quite new. As may be seen in the front view of the car at the head of this description, each headlight has a small separate lamp above it and the casings are, of course, integral. The list price, $975, includes a spare rim, and the tires are 32 by 3 1-2 inches.

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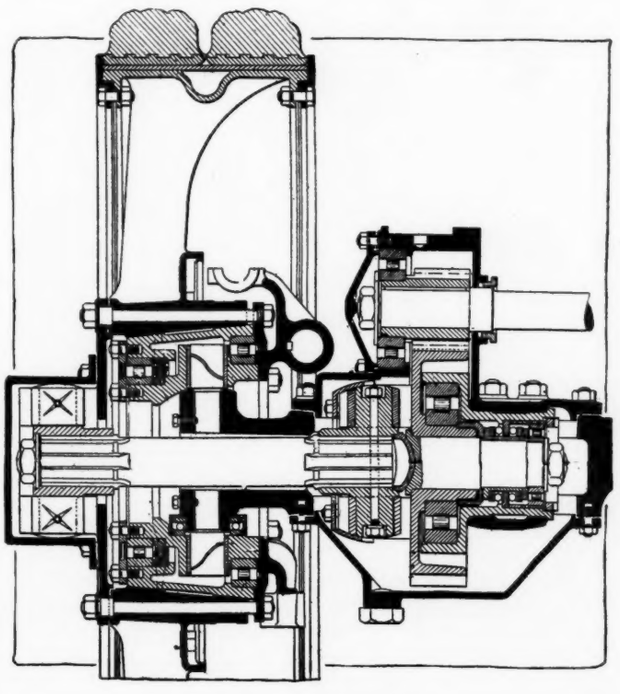
Front Wheel Drive Design

THERE have been many designs for front wheel driving and the subject is one that has formed a basis for many patents. Of these one of the most recent is of British origin, and has for its purpose the minimization of the troubles attendant upon the use of very short universally jointed shafts. It is well known that the effect of a single universal joint is to produce variations in the velocity ratio of two shafts which it connects, unless these shafts are in line axially. By dividing the angular deviation between two joints this difference in ratio can be reduced in extent, and also the amount of work thrown on each joint is less than half that which would have to be done by a single joint.

The idea illustrated is to have a front wheel hub containing a central pivot and one of the two universal joints located within the hub cap while the other is at an equivalent distance inwards of the steering pivot. Connecting the two is a short shaft with splined ends which allow it to telescope within the universal pins for the attachment of the joint pins, but these splines are not used as slides. The proportions are such that the two universals are at equal distances on either side of the pivot and all sliding takes place on the nuts of the outer joint which is within the hub cap.

It should be noticed that the road wheel is detachable, being held up on a conical hub shell by a ring of bolts.

As shown the wheel is arranged to be driven through a spur gear, the upper pinion being on one of the shafts from a differential located centrally upon the front axle, but the patentee also shows that this is not an essential part of the design, since it is possible to attach the inner universal to the differential shaft direct.

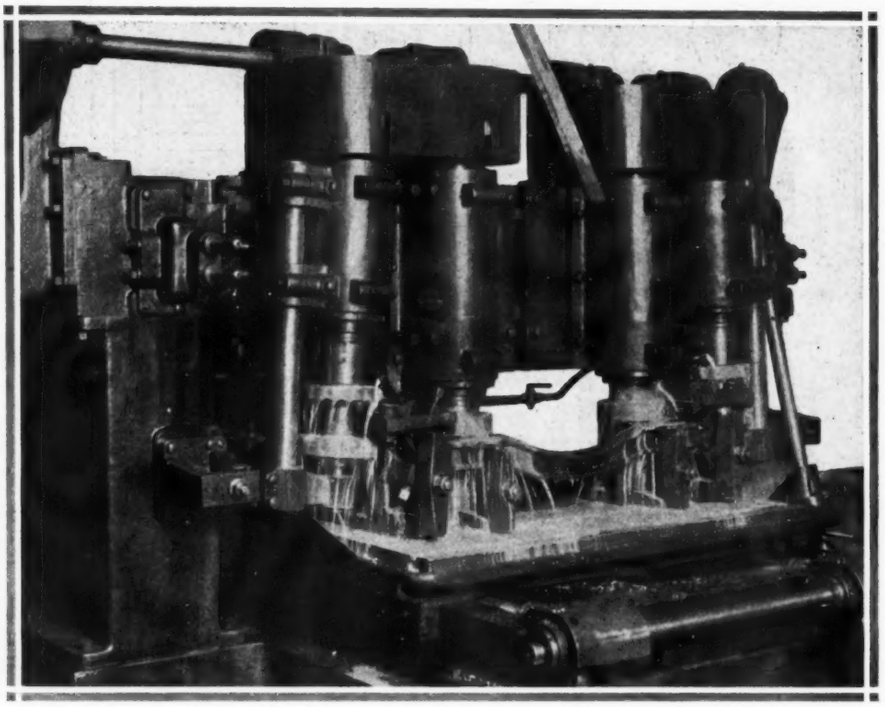


Thomas front wheel drive

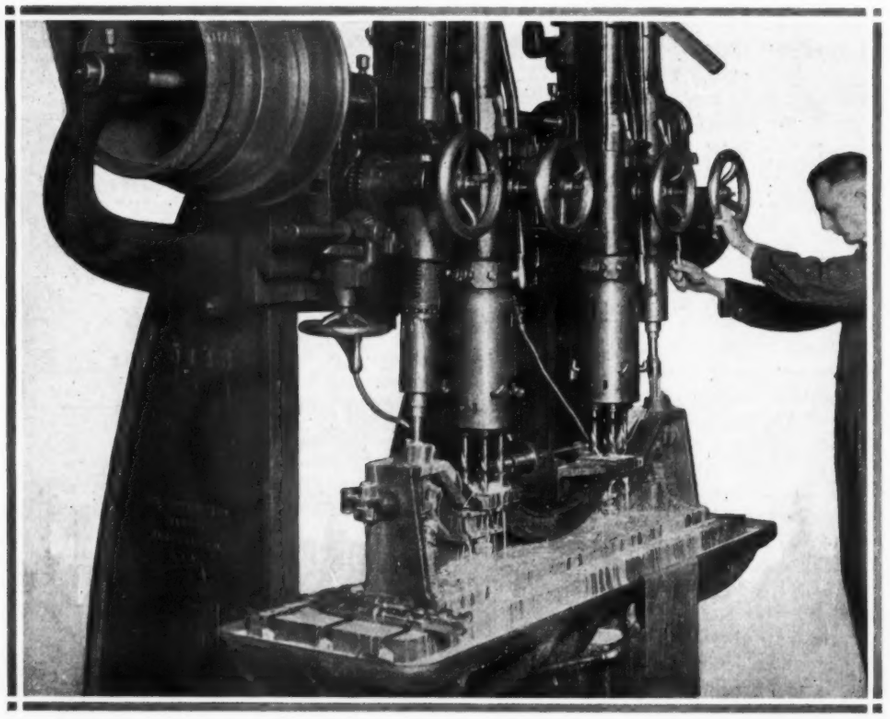
Twin Machines for Packard Rear Axles

A PAIR of twin machines take care of the axle work on Packard cars. One is for drilling and the other is for milling and by their use considerable time is saved in the completion of the front axle. The speeds of the two machines are very nearly equal although the operations, of course, differ essentially. The time required to drill the axle is 18 minutes, to mill it takes 19 minutes. In addition to this, the setting-up time must be included in the estimate but with a new jig which has just been designed, it requires only 2 minutes to mount the axle in either machine.

The drilling machine is of special interest in that it not only does the actual drilling work but also takes care of the taper reaming. Thus, the machine actually does the work of drilling and reaming and when an axle has left it, there is no further work of this nature to be done. With the ordinary multiple-spindle drill it would be necessary to perform two or three operations on each axle and the time required would probably be about four times that necessary with this combined drilling and taper reaming outfit.



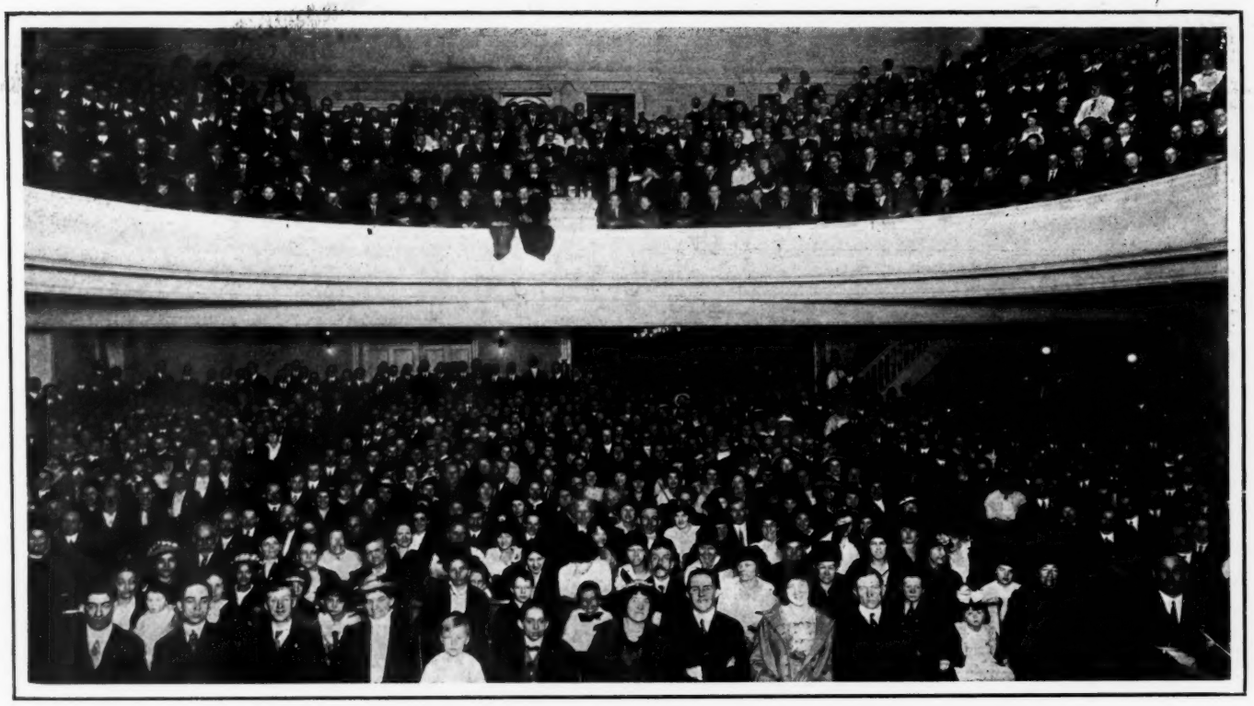
The Packard milling machine has four cutters in operation at the same time, two of them being double and in reality having two cutting surfaces giving a total of six cuts at a time. The axle is placed in a fixture on the table of the machine and the milling cutters set in operation. The time required to mill the axle is 19 minutes



To drill the axle requires 18 minutes. With the new jig which is now employed it only requires 2 minutes to mount the axle in the machine. The drilling operation not only includes the actual drilling but also the taper reaming

The milling machine has four cutters in operation at the same time, two of them being double cutters in that they have two cutting surfaces which are actually engaged in one operation. The work done, therefore, is virtually that accomplished by six cutters as six separate cuts are made in one operation. As shown in the accompanying illustration, there is an especially arranged fixture on the table of the machine which need only be clamped in place before setting the machine in motion.

These machines require but one attendant apiece and the work is so carefully timed that the workmen is not permitted to allow any appreciable lapse of time between the finishing of one axle and the commencement of work on the next. The machines do not require as much space as many other milling and drilling machines designed for the same work and furthermore, are practically automatic in their action, giving results of desirable uniformity and working at desirable cutting speeds.



1,500 members of the Sheldon Axle & Spring Co. Relief Assn. with their families who attended the second annual entertainment and social session of the organization

Welfare Work Gains in Sheldon Plant

Axle & Spring Co.'s Relief Assn. Comprises 75 Per Cent. of Employees—Has $7,000 in Treasury

TOTAL receipts of $17,920.53 and expenditures of $11,-173.78 with a surplus fund on hand of $7,000 is the record of the Sheldon Axle & Spring Co. Relief Assn. for the 8 years in which it has been in existence. At the annual meeting held early this month the secretary's report showed receipts for the past year of $2,178.48, the death and sick benefits paid to members or their families having been $1,256.35, leaving a surplus for the year $923.13. At the time of this meeting the balance in the treasury was $6,746.75 and the Sheldon company donated $253.25 to make an even $7,000 of which $5,000 is invested in securities netting an annual income of $300, which is equivalent to 100 memberships paying 25 cents monthly dues on which there is no possibility of having to pay any sick or death benefits.

75 Per Cent. of Employees Are Members

At the present time the membership of the association comprises approximately 75 per cent. of the employees of the Sheldon organization. The dues are 50 cents per month for the first year and 25 cents per month thereafter. Sick benefits are paid at the rate of $6 a week for 12 weeks and $3 for the following 8 weeks or $96 in 1 calendar year. Death benefits are $100 for a member of the association; $25 for the death of his wife and $15 for the death of a member's child between the ages of 5 and 14 years.

1,500 at Annual Entertainment

The association holds an annual entertainment and social session each spring for the employees of the company and their families, the cost of the entertainment being defrayed by the company. At the second annual function of this character held March 25 approximately 1,500 employees and their families were in attendance. On the first Saturday of August every year the association holds an annual picnic and field day at which various athletic events are contested, suitable medals and prizes being given to the winners.

Officers of the Relief association are elected yearly and are as follows: President, James Marshall; vice-president, Wilbur Sprung; treasurer, C. A. Ide; secretary, E. A. Jones; auditors, Howard Davis, L. P. Holdsworth and Harry Hemstreet.

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An Automobile Course for Women

MILWAUKEE, WIS., April 10—To meet the demand of the growing class of women motorists in Milwaukee for a course of instruction in the construction, care, operation and maintenance of the modern motor car, Prof. E. M. Barrows, Milwaukee district representative of the University Extension Division of the University of Wisconsin, who is in charge of the course established last fall, has arranged for a new course of ten lectures exclusively for women. The men's course is now in its second series, because of the demand that it be repeated. The woman's course will be given each Friday afternoon at 4 o'clock for 10 consecutive weeks. The men meet each Monday evening at 8 o'clock. The courses are given in the University Extension Building, 471 Van Buren street, Milwaukee. Experts of the State university engineering college staff conduct the work and all were formerly connected with motor car or parts factories. The work laid out for the women students does not include actual operations that might soil hands or clothes.

THE AUTOMOBILE

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New York's Speedway

WITH the assurance that Greater New York is to have a 2-mile automobile speedway, the East gives promise of coming back to its own in the racing field, and Long Island, the cradle of automobile racing in America, may, within the near future, be the setting for some of the greatest speedway races in the world. Since the abandonment of the Vanderbilt Cup race years ago there has been constant sentiment that Greater New York is one of the best population centers for sporting contests of this nature and that the automobile industry is suffering an annual loss by not having some contest for its 8,000,000 of population.

Unfortunately, the financing of the new speedway is largely controlled by Wall street interests local to New York as well as allied financial interests from Chicago. To date the automobile industry has taken little part and it is somewhat of a reflection on those who have made their money in the industry that they have not more generally assisted in the promotion of the speedway. The Indianapolis speedway, entirely backed by the automobile industry, is typical of local patriotism and industrial pride; whereas New York, with its overwhelming Wall street interests and its minimum of automobile representation, would have better represented the magnitude of the industry in Greater New York if the automobile element had been considerably higher.

Sheepshead Bay speedway should prove of inestimable value to the automobile industry, not only as a national advertisement, but further as affording a great testing ground in the midst of 8,000,000 population. American manufacturers cannot overlook the opportunity that such a speedway offers them. It should prove one of the great show stands of the world, and with a management as impartial as can be had only the best interests of the industry will be served by this enterprise.

High Motor Speed

IN THE AUTOMOBILE today commences a short series of articles on the design of high speed motors, written by one who has had long experience among the racing automobile firms of Europe. One need not agree with all his deductions, but his facts are incontestable. This series are particularly valuable, because they not only help engineers who wish to make high speed motors of their own, but serve to prove that what we are now calling high speed is a snail to an express train in European practice.

Perhaps there is nothing useful in piston speeds of 3,000 feet per minute. Perhaps this striving after huge power for displacement volume, which has been the main characteristic of European automobile development during the past 10 years, is now being brought to an absurd extreme. It must be remembered, however, that this could have been said any time the past 8 years, and that the average engine as made here today is a long way ahead in volumetric efficiency as compared with the European motor of a few years back. We may not have moved so far as the French extremists, but we have been moving their way all the time.

It is always interesting, and generally useful, to know "how it's done." Mr. Gerster tells us this in the most lucid language, and the mechanical man who has no professional interest will find that Mr. Gerster holds his attention none the less.

Die Castings

ZINC base die castings are not satisfactory for water pump housings. All die cast metal is of a more or less brittle nature and the zinc in the alloy is very easily affected by water which causes it to corrode and deteriorate. It is this deterioration which is the chief cause of the castings giving out.

The use of die-castings is an economy because it cuts down machine work. The castings can be made in the finished state almost as cheaply as the rough casting in bronze or some similar material and then is finished without the necessity of further machining work. The reason that the majority of pump jackets are die-cast is because they can be made cheaply and accurately that way. On account of the fact, however, that these jackets and water pumps are made of a zinc base alloy which is porous in the first place and subject to rapid corrosion in the second, they are out of place. Higher-priced alloying substances, such as tin and copper, with perhaps antimony, are advocated by many as satisfactory, and surely would resist the inroads of water to a much better extent than the zinc base.

The fact that some manufacturers have made thousands of successful die-cast parts for pump housings shows that if the proper mixture is put into the metal, it will stand up, but it requires more than merely sending out broadcast for prices and then selecting the cheapest material regardless of actual value. To make die-castings as they should be requires more time and more expensive alloys than it does to turn them out rapidly from cheaper alloys. Zinc rapidly deteriorates in water and the result of the use of a zinc alloy where actual contact exists with the water is the rapid disappearance of the zinc content, leaving the shell of metal behind which soon crumbles under the slightest stress.

Important Work for S. A. E. in Detroit

Eleven of Fourteen Standards Divisions to Report

NEW YORK CITY, April 13—Eleven of the fourteen divisions or sub-committees of the standards committee of the Society of Automobile Engineers will submit reports which will be either final or of progress at the coming session which will be held in Detroit on April 22.

Among the most important communications which will be made to the committee next week are those of the Electrical Equipment Division, Iron and Steel Division, Electric Vehicle, Research Division, Springs Division, Miscellaneous Division, Carbureter Fittings Division and some of the subcommittees of these divisions.

The Electrical Equipment Division will report on the proper limitations of headlights in the city. In some of the cities ordinances have been passed defining permissible glare of headlights. The S. A. E. committee will attempt to set forth the conditions of proper car illumination, particularly on the relatively dark streets and parks found in many of the large cities. Tests will be made of some of the dimming, shading and screening devices now on the market, as illustrating the principles under consideration. It is also the intention to refine further the standards of bulb bases, sockets and connector plugs for the sake of better interchangeability and consequent improved operation. In addition, the possibility of standardizing the arrangement of engines for attaching starting motors will be taken up.

Iron and Steel Report Expected

New data are expected from the Iron and Steel Division on the physical properties of S. A. E. alloy steels, as well as further recommendations as to specifications of steel castings, and the vanadium minimum limit in vanadium steels. It has been suggested that a standard tooth form for silent chains be adopted. The importance of this is realized by car manufacturers using more than one make of chain. As it is now, it is absolutely necessary for them to have differently cut sprockets for each make of chain, to get proper results. It would be of great advantage if the chain makers would adopt some standard, and a report as to the feasibility of doing this will be made at the coming meeting of the standards committee.

The need of coordinated design and production of electric as well as gasoline vehicles is appreciated. The Electric Vehicle Division of the society made a report involving fundamental considerations last January, but this report was, owing to the development of a marked difference of opinion among the engineers, referred back. A revised report will be made this month on speed and mileage ratings, motor voltage, efficiency tests of solid tires, and number of cells in standard battery equipment.

A subject of considerable economic value which is under consideration by the Research Division of the standards committee, is that of tap drill sizes. A common saying in regard to taps is that 90 per cent. break instead of wear out. This means not only large tap expense but expensive delay in getting new taps and resetting machines, and the costly processes used to remove broken taps and the expensive pieces rendered useless by having broken tap-ends left in or having the tap holes spoiled in an attempt to remove the taps. This waste is almost wholly unnecessary, being avoidable by properly designed taps and proper sizes of tap drill holes. There are many arguments in favor of a tap drill list which can be applied in automobile practice generally. The Research Division has now in preparation an extensive series of tests to be conducted with tapped holes of varying depth of thread, and test pieces of different steels with S. A. E. and U. S. S. threads cut thereon.

The Research Division will also report finally on the matter of a vehicle taxation formula.

One of the most complex elements of car construction is leaf springs.

The Springs Division is now formulating for consideration at the Standards Committee meeting at Detroit next week, a report on:

1. Nomenclature of cantilever springs.
2. Test of parallelism of eyes and master leaf of leaf springs.
3. Modification of eye and bolt tolerance for leaf springs.
4. Frame brackets for leaf springs.
5. Nuts for spring clips of leaf springs.
6. Modification of center bolt standards for leaf springs.
7. Width of springs for pleasure and commercial cars.
8. Center bolt nuts of leaf springs.
9. Length, opening, etc., of spring clips of leaf springs.
10. Spacing of clips.
11. Pressure blocks.

The Miscellaneous Division will report on:

1. Dimensions of piston ring grooves.
2. Hose and hose clamps for cooking systems.
3. Flat fan belt widths.
4. Dimensions of mechanically-driven air pumps.
5. Sizes of screws and bolts for use in mounting dash-board fittings.
6. Position of number on motors.
7. Thread tolerance.
8. Cotter pin sizes.
9. Speedometer-drive shaft-ends.

It has developed that there are a great many unnecessary and immaterial dimensional differences in piston ring widths and thicknesses. Standard sizes of hose and hose clamps will be of great advantage. There is need for specifying a list of flat fan belt widths which would reasonably be used, and of setting forth the permissible variation in these widths, the latter being an apparently simple but not clearly understood point. It has been stated that in the mounting of dash fittings one diameter of screw or bolt with a specified style of head and pitch and thread is sufficient. With regard to the position on a motor of its number, it has been found that in the case of stolen cars, it is important that the police shall know where to look for the number of the motor, which for this purpose should obviously be at an easily seen place. This is an example of advisable recommended practice which is important in one way, while very trivial in another.

Thread Tolerance Unsettled

The matter of thread tolerance of machine screws and bolts is one that has never been settled, largely for the reasons that different grades of work require different standards in this connection, and that in any case an accurate method of thread measurement must be devised, this measurement involving several variables.

It is expected that after settling on a list of sizes, the Miscellaneous Division will report that instead of carrying 200 cotter pin sizes in stock as is now frequent practice, twenty should suffice for any car manufacturer.

There appears to be no good reason why the shaft-ends of speedometer drives furnished by the various instrument manufacturers, should not be standard, so as to interchange on a given make of car.

Several features of carbureter fittings have been standardized by the S. A. E. Subjects now before the Carbureter Fittings Division are:

Exhaust manifold hot-air jackets for carbureter connection.
½-inch and ⅝-inch carbureter outlet connections.
2½-inch and 3-inch carbureter flanges.
Uniform dimensions from center to face of side-outlet carbureters.

MACAO, CHINA, March 10—The Hingkee Auto Garage, this city, desires to receive offers from automobile parts manufacturers for the opening of connections in China.

Court Dismisses Kardo Axle Suit

Holds Co. Is Not Lawfully Organized Under Laws of Ohio as 10% of Stock Is Not Paid In

CLEVELAND, O., April 13—*Special Telegram*—Judge John H. Clarke, in the United States district court, has dismissed the patent infringement suit of the Kardo Co. against Henry J. Adams, dealing as the Reo Motor Sales Co. His opinion, sixteen pages long, held the Kardo Co. not lawfully formed under the statutes of Ohio.

Judge Clarke pointed out that innuendos at the February hearing prompted him to make investigation of the organization.

"Articles of incorporation for the Kardo Co. were signed February 21, 1914, by five men who are members of the law firm of the organization."

The decision reads: "Each subscribed one share of stock; one subscribed as trustee of the American Ball Bearing Co. for 995 shares, payable $9,500 in cash and $90,000 by transfer of patents by the American Ball Bearings Co. to the Kardo Co.

"The Ohio laws differ from the laws of many states in that the mere filing of articles of incorporation in due form does not create a corporation, notwithstanding the provision that a certified copy of articles shall be prima-facie evidence of its existence. The law requires that 10 per cent. of the stock be paid in. This was not done.

"While there is no disposition on the part of the court to impute actual or intended fraud to the parties engaged in this enterprise, yet the law of the case is not different from what it would be if such were the fact."

The suit was brought by the Kardo Co. substituting for the American Ball Bearing Co., in action against Henry J. Adams, former representative for the Reo Motor Car Co., and dealing locally as the Reo Motor Sales Co. The Kardo Co. charged infringement of Patent No. 792,690 issued to Alanson P. Brush, of Detroit, by the use of a compensating mechanism termed a floating spider in the bevel gear of the rear axle on Reo cars. Last month Judge Clark ordered a reopening of the suit, as the first step in a further investigation into the organization and purpose of the Kardo Co.

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Cadillac Files Appeal on Austin Two-Speed Axle Decision

CINCINNATI, O., April 10—An appeal was filed in the United States Circuit Court today by the Cadillac Motor Car Co., Detroit, and John M. Van Loon, agent of the Cadillac company in Kalamazoo, Mich., against the decision rendered January 8, in Grand Rapids, Mich., by United States District Judge C. W. Sessions, who held that the Cadillac company had infringed the two-speed axle patent of Walter S. Austin, of the Austin Automobile Co., of that city.

Walter S. Austin started his suit against the Cadillac company and its Kalamazoo agent in July, 1914, claiming that the Detroit manufacturer was infringing upon patent No. 1,091,618, which was issued to him March 31, 1914, concerning two-speed axles.

In his decision rendered January 8, Judge Sessions held the Austin patent claims to be valid.

It is probable that the Cincinnati case will not come up for hearing until fall.

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U. S. Supreme Court Denies Petition for Rehearing in Bearing Suit

WASHINGTON, D. C., April 12—An attempt to bring the case of the Hess-Bright Mfg. Co. and Deutsche Waffen und Munitions Fabriken against Hedwig Fichtel and Ernst Sachs before the United States Supreme Court for review and determination by petition for a writ of certiorari has been denied by the Supreme Court of the United States. This undoubtedly marks the termination of this suit.

It will be remembered that the United States circuit court of appeals for the third circuit last month affirmed its decision in favor of the Hess-Bright Mfg. Co. and refused the motion for rehearing as to the right of an accounting made by Fichtel and Sachs.

The suit was brought in 1913 by the Hess-Bright Mfg. Co., of Philadelphia, and the Deutsche Waffen und Munitions Fabriken of Germany, against Hedwig Fichtel and Ernst Sachs doing business under the firm name of Fichtel & Sachs, charging infringement of the Conrad patents Nos. 822,723 and 838,303 covering the use of a continuous race in a ball-bearing. Judge McPherson, of the U. S. district court in Philadelphia, handed down a decision in favor of Fichtel and Sachs in December, 1913, but on the appeal the circuit court of appeals, Philadelphia, reversed this decision and gave the verdict to the Hess-Bright Co. holding the Conrad patent to be valid and infringed by the F. & S. bearing.

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Overland Declares an Extra 5 Per Cent. Dividend on Common Stock

NEW YORK CITY, April 14—The Willys-Overland Co., Toledo, O., has declared the regular quarterly dividend of 1 1-2 per cent. on the common stock and in addition a 5 per cent. stock dividend. Both dividends are payable May 1 to stockholders of record April 22.

The company since its incorporation in November, 1912, has paid 7 per cent. on its preferred stock and 6 per cent. regularly on its $20,000,000 common stock. Furthermore, in August, 1913, an extra cash dividend of 5 per cent. was declared on the common.

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Michigan Castings Declares 200% Dividend

DETROIT, MICH., April 11—A dividend of 200 per cent. to the stockholders of the Michigan Steel Castings Co., has been authorized by the directors. It represents a part of the earnings of the concern since it was founded 8 years ago, and during which time the profits were not distributed in order to build up the business. The capital stock will now be increased from $90,000 to $210,000.

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DETROIT, MICH., April 12—The J. W. Murray Mfg. Co., which makes car specialties, has declared a dividend of 100 per cent. and increased its capital stock from $60,000 to $200,000. Recently a one-story brick addition 40 by 168 feet was completed, and now a further increase in the size of the plant is contemplated.

Market Reports for the Week

NEW YORK CITY, April 14—Market prices this week were more or less steady with the exception of a few in the metal markets where tin was unsettled yesterday and lead was dull and weaker. Both coppers were strong but dull. Tin this week went up $7.50 per 100 pounds, one of the largest gains shown by this metal. Prices in this metal, however, fluctuated, the highest price being quoted on Friday, when it reached $59.00, after which a drop and then another rise and drop occurred, the closing price on Tuesday being $56.00. Lead went down 2 1-2 cents per 100 pounds. Rubber experienced a fractional gain of 1-2 cent. Tire scrap went down 1-2 cent. There were no changes in the oil and lubricant markets.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.21½	.21½	.21½	.21½	.21½	.21½	.....
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	.....
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	.....
Copper, Elec., lb.	.15⅞	.16	.16	.16	.16⅛	.16¼	+.00⅜
Copper, Lake, lb.	.16¼	.16¼	.16¼	.16¼	.16¼	.16½	+.00¼
Cottonseed Oil, bbl.	6.65	6.55	6.55	6.55	6.55	6.50	—.15
Cyanide Potash, lb.	.21	.21	.21	.21	.19	.21	.....
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	.....
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	.....
Lard Oil, prime	.92	.92	.92	.92	.92	.92	.....
Lead, 100 lbs.	4.20	4.20	4.20	4.20	4.20	4.17½	—.02½
Linseed Oil	.62	.62	.62	.62	.62	.62	.....
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	.....
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	.....
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	.....
Rapeseed Oil, Refined	..	..	..	..	..	..	.....
Rubber, Fine Up-River, Para	.58½	.59	.59	.59	.59	.59	+.00½
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	.....
Silk, raw, Japan	..	3.55	..	..	3.55	3.55	.....
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	48.50	50.00	59.00	54.00	58.00	56.00	+7.50
Tire Scrap	.04¾	.04¼	.04¼	.04¼	.04¼	.04¼	—.00½

Overland Electrifies Enamelling Ovens

TOLEDO, O., April 9—An improvement of much importance to the automobile industry has been installed at the Willys-Overland factory, Toledo. This company recently closed what is probably the largest industrial contract for electric power ever given to a central station. The contract calls for the electrification of sixteen large enamelling furnaces having a volume of 48,000 cubic feet and a capacity of 140 tons of enamelled product every 10 hours. The work put through the ovens consists of various sizes and shapes of steel parts. With the 4,500 horsepower previously required from the same station, the new furnaces will make the total now used by the Overland company approximately 10,000 horsepower load. According to electrical engineers, this is fully as large as the total power required for lighting a city of 225,000 inhabitants.

One Oven in Operation.

One of the ovens which has been in operation for several months has given results far superior to any previously obtained by the Overland company, which formerly used gas in the place of electricity, as nearly all other automobile manufacturers are doing.

The equipment of the ovens makes them almost entirely automatic in operation. When the oven is loaded the closing of its doors automatically throws a switch which turns on the current. A pyrometer which can be adjusted to operate at any desired temperature rings a bell when the proper degree of heat is reached, thus notifying the attendant, and also automatically turning off the current.

With the elimination of flue gases usually found in enamelling ovens, the work is said to be made cleaner and smoother and that a brighter finish is given to the materials. Dirt and spots attendant upon the gases have disappeared and the necessity for ventilation has been reduced to a minimum, reducing air currents and the possibility of picking up dust which may find its way into the ovens and cause a slight flaw in the work.

50 Per Cent. Gain in Efficiency

The volume of work which can be accomplished with the new installation is almost half again as great as was possible with the old equipment. This makes possible a proportionate reduction in the cost of enamelling each unit.

The installation of electrically-heated ovens is said not only to increase the manufacturing efficiency of the plant but also to do away with all of the hazards attendant upon the work. The fire danger is entirely eliminated, explosions are done away with and the safety of the attendants is assured. The non-oxidizing heat cannot scald the operator and the heat of the surrounding atmosphere is materially decreased, making the working quarters entirely comfortable. These better conditions are reflected in a higher grade of work.

Automobile Securities Quotations

NEW YORK CITY, April 13—Securities this week continued their skyward movement. The biggest day of the year occurred on Friday, when many new high prices were made with over 1,000,000 transactions, the biggest public buying in 2 years.

Tire issues showed the largest gains for the week. Firestone common went up 17 points, reaching the high mark of 455; Goodyear common went up 20 points, closing at 240; Goodrich common rose 8 1-4 points while its preferred showed a gain of 3 points; Kelly-Springfield common went up 9 points and its second preferred gained 7 points; Miller Rubber common closed at a 15-point gain; Swinehart closed at 90 with a gain of 10 points for the week and U. S. Rubber common rose 7 3-8 points.

Receipts of large war orders by the automobile manufacturers had a lot to do in the large gains made by several of the automobile stocks. International Motors caused considerable surprise in Wall street when its securities found an open market on the Curb. Its common rose 9 points and its preferred 14. General Motors continues to rise, this week showing a gain of 18 3-4 points on its common and 16 1-2 on its preferred. The common has been the stock on which the public interest has centered. Just 1 year ago that stock sold at 37 3-8, compared with 25 for 1913. Before the end of 1914 it reached 99. Early this year par was crossed; a week ago the price was 126; yesterday 144 3-4 was reached. That means an advance of over 100 points in a year.

Willys-Overland common this week rose to 129 1-2 at a gain of 4 1-2 points. Studebaker made a gain in its common of 5 3-4 points. Both Reo stocks made small gains. Chalmers closed at a gain of 14 points in its common and 2 points in its preferred.

In the Detroit quotations every stock with the exception of Packard preferred, showed gains. General Motors and Continental Motor common showed the largest changes, the former 16 points and the latter 10.

In the inactive stocks Canadian Ford showed a rise of 50 points.

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Net Ch'ges
Ajax-Grieb Rubber Co. com	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd	99	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	82½	86½	75	80	—1
Chalmers Motor Co. com	79	83	94	99	+14
Chalmers Motor Co. pfd	90	92½	92	94	+2
Electric Storage Battery Co	51	52	50	51	+2¼
Firestone Tire & Rubber Co. com	280	287	455	460	+17
Firestone Tire & Rubber Co. pfd	107	109	110	112	..
General Motors Co. com	81½	82	144¾	146	+18¾
General Motors Co. pfd	92¾	93½	119	121	+16½
B. F. Goodrich Co. com	25½	26	51¼	52½	+8¼
B. F. Goodrich Co. pfd	86½	89	102½	104	+3
Goodyear Tire & Rubber Co. com	160	170	240	245	+20
Goodyear Tire & Rubber Co. pfd	95	96½	104	105	+1½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	14½	15½	+9
International Motor Co. pfd	..	15	32	35	+14
Kelly-Springfield Tire Co. com	..	..	138	139	+9
Kelly-Springfield Tire Co. 1st pfd	..	..	84	85	+ ¼
Kelly-Springfield Tire Co. 2d pfd	..	..	137	141	+7
Maxwell Motor Co. com	7½	8½	46	47	..
Maxwell Motor Co. 1st pfd	32½	33½	84	85½	—1
Maxwell Motor Co. 2d pfd	11¾	12¼	39½	49½	— ½
Miller Rubber Co. com	..	..	185	190	+15
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	123	125	138	140	—1
New Departure Mfg. Co. pfd	104	106	106	..	+1
Packard Motor Car Co. com	103	..	80	92	..
Packard Motor Car Co. pfd	94	98	94	97½	+ ¼
Peerless Motor Car Co. com	15	..	20	21	..
Peerless Motor Car Co. pfd	..	75	..	55	..
Portage Rubber Co. com	..	25	34	36	..
Portage Rubber Co. pfd	..	75	85	95	..
*Reo Motor Truck Co	7¾	8¾	13½	14½	+1
*Reo Motor Car Co	19½	20¾	32½	33½	+2½
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	55	60	58	59	— ½
Stewart-Warner Speed. Corp. pfd	100	102	102	105	..
Studebaker Corporation com	33	33½	66½	67½	+5¾
Studebaker Corporation pfd	85	87	99½	100½	..
Swinehart Tire & Rubber Co	60	65	90	95	+10
Texas Company	140	141	138	140	..
U. S. Rubber Co. com	60	60½	72¼	73½	+7⅜
U. S. Rubber Co. pfd	103¼	104	108	110	+1¾
Vacuum Oil Co	128	130	208	212	+9
White Co. pfd	107	110	103	108	..
Willys-Overland Co. com	64	66	129½	131	+4½
Willys-Overland Co. pfd	89	94	100½	102	+ ⅛

*Par value $10; all others $100 par value.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Bid	Asked	Net Ch'ges
Chalmers Motor Co. com	79	82	90	93½	+5½
Chalmers Motor Co. pfd	90	92½	92	95	+2½
Continental Motor Co. com	150	..	170	180	+10
Continental Motor Co. pfd	..	75	78	84	+2
General Motors Co. com	81	83	142	146	+16
General Motors Co. pfd	92½	94	104	107	+3¼
Maxwell Motor Co. com	7¾	8½	46	47½	+ ½
Maxwell Motor Co. 1st pfd	33	34	84	86	+1
Maxwell Motor Co. 2d pfd	11¾	12½	39	41	— ½
Packard Motor Car Co. com	103	..	86	..	+6
Packard Motor Car Co. pfd	94	98	93¾	..	..
*Reo Motor Car Co	19¾	20½	32½	33½	+2½
*Reo Motor Truck Co	7¾	8¾	13	14	+ ½
Studebaker Corporation com	..	..	67	68½	+6½
Studebaker Corporation pfd	..	..	100	103	+2

INACTIVE STOCKS

*Atlas Drop Forge Co	..	26	..	21	..
Ford Motor Co. of Canada	..	560	600	..	+50
Kelsey Wheel Co	195	..	190	200	..
*W. K. Prudden Co	19	20½	..	21	+ ½
Regal Motor Car Co. pfd	..	45	12	20	—2

BONDS

General Motors, notes, 6s, 1915	100¾	101½	101	..	..
Packard Motor Co. 5s, 1916	95	98½	..	84	..

*Par value $10; all others $100 par value.

Pa. Bill To Double License Fees

Taxes According to Horsepower—Dealer's Tags Also Doubled and Solid Tire Vehicles Affected

HARRISBURG, PA., April 9—A bill has been introduced by Representative Lipschutz, Philadelphia, which will double automobile license fees. This bill taxes according to horsepower. The following table shows the present and proposed automobile fees.

	PROPOSED	PRESENT
Under 20 h.p.	$10	$5
From 20 to 35 h.p.	20	10
From 35 to 50 h.p.	30	15
More than 50 h.p.	40	20

For solid tire vehicles, excepting traction engines, the proposed and present rates are:

	PROPOSED	PRESENT
Less than 4,000 pounds	$10	$5
More than 4,000 but less than 5,000	20	10
From 5,000 to 10,000 pounds	30	15
From 10,000 to 15,000 pounds	40	20
From 15,000 to 24,000 pounds	50	25

On vehicles weighing less than 10,000 pounds trailing after an automobile or solid tire vehicle a fee of $6 is proposed by the bill against $3 under the present act. Trailers weighing between 10,000 and 24,000 pounds must pay a fee of $10 against the present fee of $5.

The cost of dealers' tags is doubled to $20.

Senator Mills yesterday introduced another bill in the Senate which provides that in any civil proceeding for injury done by an automobile the register number displayed on the vehicle shall be prima facie evidence that the owner was operating it.

If he shall prove at the hearing that he was not operating it and reveal the name of the person actually operating it, then the register number evidence is removed and the burden of proof shifted.

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Want to Double Fees in Michigan

LANSING, MICH., April 9—There seems to be no end in the desire of legislators to find the automobile—and whoever and whatever is connected or related to it—as the one means of securing more money to the state, the city or the county. The latest proposed new tax was introduced today. This bill provides for the doubling of the automobile tax fees, and does not exempt automobiles from local taxation. The license fee for automobiles would thereby be $6 instead of $3; chauffeurs' licenses would be $3 instead of $2; manufacturers' licenses are to be sold at $20 instead of $10 and for duplicate licenses the charge is to be $3 instead of $2.

The bill is to replace the Smith bill which provided for a state license tax according to weight and horsepower, but exempted automobiles from local taxation. Owing to the strong opposition from the representatives of Wayne county, who claim that this bill would reduce too much the Detroit tax rolls, the Wood bill has been introduced to take its place.

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New York One-Inspection Bill Passes

NEW YORK CITY, April 14—The Lockwood bill, which will eliminate many of the duplicating inspections of buildings in New York City, passed the state assembly yesterday. It had previously passed the Senate. The bill tends to concentrate the inspective powers of the city and was strongly backed by the automobile interests.

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Chicago Proposing Restrictions of Size and Weight for Trucks

CHICAGO, ILL., April 9—Tentative limits have been drawn up here for an ordinance to restrict truck sizes and weights. Originally, this bill specified 28,000 pounds as the maximum gross weight and 24 feet as the maximum length. Since then, however, the restrictions have been changed to 40 feet in length and 1,000 pounds per inch width of tire, with a maximum allowable load per axle of 12 tons. Aldermen W. J. Healey, G. E. Trebing and H. P. Bergen are the council committee intrusted with the drafting of the ordinance and J. D. Hittle and Mr. Robinson are the engineers who have been appointed to confer with this committee. The first draft has been passed upon for legality by Leon Hornstein of the corporation Counsel's office. The bill is to go to the council for passage at an early date.

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N. Y. Truck Restriction Hearing April 19

NEW YORK CITY, April 9—The second hearing of the Mayor's Committee on Street Traffic & Safety regarding its proposed restrictions of motor trucks and horse vehicles in New York City has been called by secretary S. W. Taylor for Monday, April 19, at 2:00 p. m., at police headquarters. The committee will be prepared to hear further arguments in behalf of motor truck and horse haulage interests as to why business vehicles should not be restricted to 24 feet in length, 7 feet 6 inches in width, 12 feet 6 inches in height, 8 miles per hour in speed and 14 tons in total weight.

The first hearing was held in the rooms of the Safety First Society, at the Craftsman Bldg., 6 East Thirty-ninth street, and, at the request of the Motor Truck Club, a second hearing was granted after preliminary arguments from the M. T. C. and N. A. C. C., and others had been heard.

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BALTIMORE, MD., April 9—A single drink of liquor imbibed by operators of automobiles will result in licenses being forfeited immediately, provided State Motor Vehicle Commissioner H. A. Roe is convinced that the licensee has been guilty of consuming intoxicants while at the wheel of a car. This edict has been issued by Commissioner Roe and he has spread it broadcast in a crusade his department is waging against reckless driving.

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YORK, PA., April 11—The House of Representatives this week went on record overwhelmingly against a bill to require lights on all vehicles after dark.

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Delco Co. Business Growth Compels E. A. Deeds to Leave N. C. R.

DAYTON, O., April 13—Owing to the growth of the Delco business within the last year, E. A. Deeds has been obliged to tender his resignation as vice-president and assistant general manager of the National Cash Register Co. in order that he may devote his entire time to the Delco company, of which he is president.

Mr. Deeds has been connected with the N. C. R. for 15 years. He has been vice-president and assistant general manager for the last 6 years.

Several years ago, he and C. F. Kettering organized the Dayton Engineering Laboratories Co. for the manufacture of electric cranking, lighting and ignition equipment for automobiles.

Recently the demands for increased production have been so insistent that more room has become necessary. The six-story factory is pushed to its utmost and is already much too small.

Two years ago, an entire city block opposite the present factory was purchased, and within the last month work on a new building that will more than double the present production was commenced. This will be finished by fall.

About 1,700 men are now employed in the Delco factory, and over 30,000 complete starting, lighting and ignition systems have been turned out since January 1.

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PITTSBURGH, PA., April 7—Stockholders of the Youngstown Sheet & Tube Co. have approved an issue of $5,000,000 new stock to provide for additions to the company's plant, including the installation of by-products coke ovens.

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KENOSHA, WIS., April 13—The Thomas B. Jeffery Co., this city, has received orders on its trucks in 3 weeks amounting to $4,000,000. Five hundred men have been added to the factory working force, which is working 24 hours a day in three 8-hour shifts.

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KENOSHA, WIS., April 9—Charles T. Jeffery, president of the Thomas B. Jeffery Co., was re-elected member of the executive committee of the Manufacturers' Assn. of Kenosha, Wis., at the annual meeting. G. H. Allen, head of the Kenosha works of the American Brass Co., was re-elected

president of the association, which operates a mutual employment bureau and clearing house that is at this time rendering invaluable aid to Jeffery and other works having large war orders requiring day and night operation.

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WASHINGTON, D. C., April 11—The American automobile has been most popular with the Allies. A total of 4,352 commercial vehicles have been purchased by England, France and Russia in Europ and Asia in the 7 months ended February 28. The value is placed at $12,365,943, an average of $2,841 for each truck.

The greatest number of these trucks were sold to France, 2,277, valued at $6,317,150, being exported in the first 7 months of the war. England is second with 1,559, valued at $4,030,261. Russia in Europe bought 305, valued at $1,280.-187, and Russia in Asia 211, valued at $738,345.

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NEW YORK CITY, April 14—William R. McCulla, former research engineer of the Packard Motor Car Co., Detroit, Mich., and now assistant chief engineer of the Knox Motors Co., Springfield, Mass., will sail from this city on April 17 on the French steamer Niagara to Bordeaux, France, on a business trip.

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Pennsylvania Reduces Prices on Tubes

NEW YORK CITY, April 14—The Pennsylvania Rubber Co., Jeannette, Pa., has reduced the prices on its inner tubes, effective April 15. The following list gives the former and new prices on a few of the tubes: 28 by 3, red tube, former price, $2.60, new price, $2.35; 30 by 4, gray tube, former price, $4.00, new price, $3.60; 32 by 4 1-2, Nugray tube, former price, $4.85, new price, $4.35.

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NEW YORK CITY, April 14—G. M. Graham, designing engineer for the Massnick-Phipps Mfg. Co., Detroit, Mich., manufacturer of the Perkins 4- and 8-cylinder motors, of which Mr. Graham is the designer, has taken charge of the purchasing in conjunction with the engineering end.

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Walpole Tire Sale Is Confirmed

BOSTON, MASS., April 10—Judge Dodge in the United States district court has confirmed the sale of the Walpole Tire & Rubber Co. to the New York creditors' committee. The committee bid $780,000 for the property at public auction on March 10. The stockholders who bid $775,000 endeavored to have the sale set aside and a new one ordered on an offer of $800,000 on their part. This sum, it was represented, would satisfy all claims of creditors in full. An appeal will be made from the decree of confirmation.

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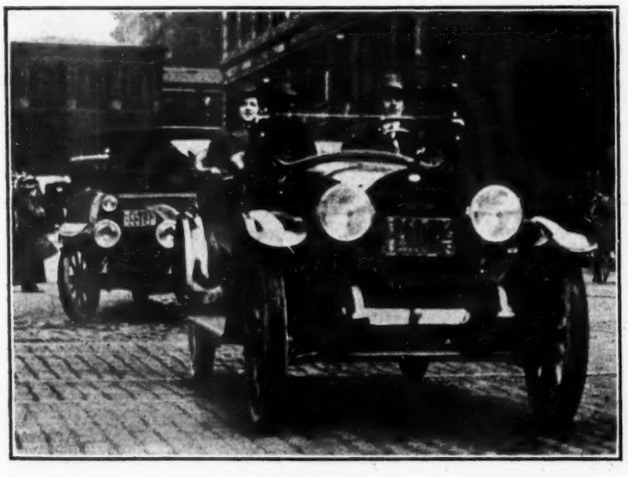
READING, PA., April 11—The S. G. V. Co., Reading's largest manufacturing automobile concern, with offices and factory at 302 North Eighth street, has suspended operations indefinitely, according to a statement given out at the offices of the company. It is said that the firm and plant is being reorganized, but no details were given out.



Marmon 41 on high-gear economy run in congested Chicago

Traffic Congestion Wastes Fuel

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Marmon Demonstrates in Chicago's Business Section Effect on Gasoline Consumption

CHICAGO, ILL., April 8—That traffic conditions have a great deal to do with fuel economy was demonstrated clearly today in a unique test when a Marmon 41 was driven through every street of the loop, Chicago's most congested business district, with the gearset lever locked in high. The car criss-crossed the loop in both directions, traveling first through all the east and west streets and then through all the north and south streets, covering 10 1-2 miles in its journey through the section bounded by the elevated railroad structure.

Accurate account of the gasoline used on this trip was taken and found to be 1.355 gallons for the 10.5 miles. This gives a consumption of 7.75 miles per gallon for the congested district. The car was then taken out on the dirt roads of Grant park where the conditions approach very close to ordinary touring conditions. Here the economy was found to be nearly double that obtained in the loop, the car running another 10.5 miles on only .666 gallons, making 15.75 miles per gallon for the road test.

During the 10 1-2 mile journey through Chicago's most congested traffic, sixty-seven stops were necessary in compliance with the traffic policemen's whistles or on account of blocked streets. At other times it was necessary to run at speeds as low as 2 1-2 and 3 miles per hour.

After each of these sixty-seven stops the engine started the car on high, with a steady, even pull and exhibited no tendency to labor even when, as was the case most of the way, seven persons were aboard. In every case the clutch was dropped in and only twice did the driver slip the clutch noticeably.

The test was held under the auspices of the Chicago Automobile Club and was conducted by the club's technical committee. The car used was a five-passenger Marmon 41 having a gear ratio of 3.9 to 1 and with 36 by 4 1-2 Silvertown cord tires. It was equipped with a Stromberg carbureter.

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Plant for Dr. Rittman

PITTSBURGH, PA., April 9—Experiments are being conducted here by Dr. Walter F. Rittman, who has evolved methods for extracting benzol and toluol from crude petroleum. The work is being done in a temporary laboratory, but construction of a new plant, which an oil company has agreed to build in order to try out the Rittman discoveries, will begin within the next few weeks. The plant will be situated near the new testing station of the United States Bureau of Mines.

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BIRMINGHAM, ALA., April 7—The Woodward Iron Co. will build a benzol plant, the cost of which is estimated at $200,000. Its production will be about 2,000 gallons of benzol a day.

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Brewster-Knight Four-Cylinder Chassis Ready for Production

NEW YORK CITY, April 12—The Brewster-Knight chassis of which considerable rumor has been going around throughout the automobile industry will shortly be in a state of actual production. The experimental job which a representative of THE AUTOMOBILE was offered the first opportunity of viewing today has now run 4,167 miles on the roads throughout this vicinity and with few exceptions is a good representation of what the finished job will be.

The new Knight product was designed by Owen Thomas, engineer for Knight & Kilbourne at the Brewster Bros. plant in Long Island City. It incorporates a Knight engine of standard design with its 4 by 5.5-inch cylinders cast in a single block. The Knight characteristics have not been altered in any degree, but the auxiliary fittings have been made to suit this particular mounting. A good example of this is in the arrangement of the water pump and magneto which are driven from a single shaft on the right side of the motor through a leather flexible coupling. The Bosch

magneto is tilted slightly in its mounting on the crankcase to bring the armature shaft out far enough to make a suitable connection for the straight line drive of the water pump shaft.

Gasoline will be fed by the Stewart-Warner system which is supplied by an 18-gallon gasoline tank mounted on the rear of the frame. Lubrication is by a full pressure feed with leads to each sleeve bearing surface and through all the main bearings.

Only One Universal in the Drive

The drive is taken by a cone clutch which is faced with fabric and provided with engaging springs to a three-speed gearset. There is only one universal in the drive, this being a leather design at the forward end of the driveshaft. Besides the universal there is a laminated steel plate joint which provides an easy means of adjustment fore and aft in the length of the driving members. Final drive is through spiral bevel gears to a floating axle. The ratio of reduction between the drive pinion and large differential gear is 4.08 to 1 on the experimental car and this reduction will probably be adopted for the final job. The driveshaft is inclosed in a torque tube which takes the drive and the entire drive is floating by the use of a design which includes a rigid connection between the torque tube and the gearbox and a ball joint connection between the gearbox and the frame.

On the experimental car there is a U-S-L starting and lighting system and the probability is that this will be adopted on the final job. There are many other features, however, which are not fully determined. One of these is the springing which although probably a modified Lanchester design, giving a long cantilever having an overall length of 102 inches has not as yet been fully decided upon. The tires will be 34 by 4 1-2 inches, the wheelbase 125 inches, and the turning radius 32 feet. The brakes are connected to the operating mechanism by cable connections.

The price of the stripped chassis will be $4,000 and the body will be of special design to suit the needs of the purchaser, although a few stock bodies will be put through as standardized design. The idea of the Brewster company is to build in this country a medium-size high-priced chassis which will involve all the careful details of manufacture justified by such a price. The company has been dealing in Rolls-Royce cars and will continue to do so where a large car is specified, but owing to the delays in obtaining chassis from foreign makers they have felt the necessity of manufacturing a high-grade medium-priced car suitable for town work which they can rely upon as regards deliveries. One of the members of the firm states that they have received word from the Rolls-Royce company that the latter concern will devote their energies to parts manufacture for the present time.

Ajax Tire Winner Makes 21,985 Miles

NEW YORK CITY, April 9—The second annual Ajax tire mileage contest for employed chauffeurs has come to a close and the judges, Messrs. Alfred Reeves, general manager of the National Automobile Chamber of Commerce; President R. A. Patterson of the Tarrytown National Bank, and L. W. Scudder, certified public accountant, have declared G. C. Jensen in a Cadillac the winner with a mileage of 21,985. Prize drivers averaged 16,509 miles on at least one tire. The winner received a prize of $500. Second prize of $300 went to Frank Gray in a Peerless who covered 21,483 miles. Third prize of $200 went to A. C. Smith in a Cadillac with a mileage of 21,039 miles. There were five prizes of $100 each, the winners of which averaged around 19,000 miles.

Out of the $5,000 offered in prize money, fifty winners received $20 each, while 100 received $10 each. Two hundred and eight of the prize winning chauffeurs averaged 7,722 miles per tire, while thirty of them averaged 16,509 miles per tire; 178 of the minor prize winners averaged 6,241 miles per tire.

The company will renew the mileage contest for the 1915-1916 season with 208 cash prizes totaling $5,000. The judges and rules of the contest are the same as have governed the two previous competitions. Those winning prizes of $25 or over are given below:

MILEAGE	AMOUNT	NAME	ADDRESS	OWNER	CAR
21,985	$500	Garth C. Jensen	Stevens Pt., Wis.	John N. Welsby	Cadillac
21,483	300	Frank Gray	Chicago, Ill.	Carl N. Gottfried	Peerless
21,039	200	Alfred C. Smith	Springfield, Mass.	Oliver Smith, Livery	Cadillac
20,910	100	Laurence Ross	Ticonderoga, N. Y.	William Henry	Maxwell
20,075	100	E. C. Bode	St. Louis, Mo.	A. H. Bode, Livery	Packard
18,942	100	Albert Nathan	New York City	F. L. Young	Stoddard
18,466	100	H. W. Bode	St. Louis, Mo.	A. H. Bode, Livery	Packard
18,190	100	Herman W. Bushey	Brockton, Mass.	Francis E. Shaw	Lenox
18,148	50	Anthony B. Silvia	Haverhill, Mass.	Chas. W. Eaton	Simplex
17,452	50	L. LaFountaine	Brooklyn, N. Y.	Wm. D. Hoxie	Stevens-Duryea
16,662	50	R. L. McNeal	Ticonderoga, N. Y.	James C. Leach	Stevens-Duryea
16,617	50	Merrill W. Garber	Fitchburg, Mass.	Douglas Crocker	Packard
16,461	50	Charles W. Lewis	New York City	Donald McAleenan	Renault
16,384	50	Harry Coghlan, Jr.	Brooklyn, N. Y.	Mrs. Anne Coglan	Ford Coupe
16,071	50	S. Lichtenstein	New York City	Harris L. Rosenthal	Simplex
15,782	50	Oscar Krispien	New York City	I. Kutner	F.I.A.T.
15,500	50	Adolph Kocher	New York City	David Winkel	Cadillac
15,434	50	H. Christianson	Springfield, Mass.	O. A. Smith, Livery	Cadillac
15,237	25	Walter Wolff	Chicago, Ill.	W. F. Darndorf	Packard
15,225	25	Chas. F. Finfrock	Dayton, Ohio	Maurice Costello	Speedwell
15,101	25	Alfred B. Hovey	Lowell, Mass.	Mrs. F. B. Snedd	Stearns
14,732	25	Raymond W. Smith	Worcester, Mass.	Mrs. Helen C. Green	Jeffery
14,400	25	Geo. C. Mathis	New Haven, Conn	Mrs. Jno. Day Jackson	Cadillac
14,312	25	Frank Levine	New York City	M. Densen	Cadillac
13,844	25	Wm. H. Bodine	New York City	Bryant Motor Service	Peerless
13,792	25	Cecil Etmire	Logansport, Ind.	John M. Etmire	Buick
13,478	25	W. H. Squier	Proctor, Vt.	Vermont Marble Co.	Franklin
13,250	25	A. Nelson	Brooklyn, N. Y.	Wallace T. Jones	Pierce-Arrow
13,155	25	J. W. Simonds	New York City	R. Zeimer	Cadillac
13,090	25	Leo B. Devere	Yonkers, N. Y.	Mr. Jean N. E. St. Cyr	Packard
12,749	25	Philip Haubert	New York City	Bud Fisher	Lozier
12,655	25	Louis E. Johnson	Campello, Mass.	Mrs. G. H. Thompson	Locomobile
12,531	25	A. Sheehan	Far Rockaway, L. I.	Geo. Walden	Ford
12,462	25	George Lesser	New York City	I. S. Sanger	Lozier
12,402	25	R. Vlas Blom	Grand Rapids, Mich.	Chas. Trankla Co.	Studebaker
12,028	25	Irving E. Paul	Worcester, Mass.	T. S. Johnson	White
11,752	25	Fred Dickas	Detroit, Mich.	Geo. D. Coleman	Brush
11,587	25	Edwin T. Lachman	Reading, Pa.	Reading Eagle	AutoCar Truck
11,040	25	David L. Brown	New York City	Leo Steinfeld	Packard
10,849	25	W. A. Oldenburg	Detroit, Mich.	B. Schroeter	Overland
10,845	25	Robert Bradley	Philadelphia, Pa.	Penn. Hospital for Ins.	Packard
10,843	25	Joseph Goddard	Scranton, Pa.	P. R. Jordan	Ford
10,756	25	Roy H. Anderson	Springfield, Mass.	Mrs. Sarah J. Bull	Pierce-Arrow
10,655	25	W. H. Becker	New York City	Mrs. F. A. Schmidt	Pierce-Arrow
10,610	25	Tony Dirorl	New York City	Henry Kelly, Jr.	Columbia
10,492	25	Neil O. Bouman	Proctor, Vt.	Vermont Marble Co.	Franklin
10,177	25	Roy E. Olsen	San Francisco	Union Iron Works Co.	Packard
10,043	25	Mead H. Kimball	Scranton, Pa.	Miss M. F. Pauli	Locomobile
9,937	25	T. A. Kane, Jr.	Philadelphia, Pa.	Dusel Goodlee & Co.	Ford
9,625	25	Jos. E. Kennelly	Jersey City	Dr. F. J. Short	Cadillac
9,607	25	Robert W. Hamilton	New York City	W. A. Parker	Pierce-Arrow
9,587	25	Alfred Lofton	New York City	Arthur Israel	Cadillac
9,532	25	James McDermott	New York City	Harry N. Hempsted	Premier
9,285	25	Frank Walquist	Hibbing, Minn.	Oliver Iron Mining Co.	Ford
9,233	25	A. Walstine	Jacksonville, Fla.	A. G. Hartridge	Overland
9,227	25	Edward Snyder	Oak Park, Ill.	Jos. R. Noel	Pierce-Arrow
9,126	25	Chas. N. Peck	New York City	W. F. Tighe	Packard
8,734	25	Carl Bischoff	Sheffield, Mass.	Miss Sophia Curtis	Locomobile

Developments in the Jitney Bus Field

Dallas Traction Co. Estimates Yearly Loss From Jitney Competition at $500,000

AUSTIN, TEXAS, April 8—The interurban and street railways interests in Texas of the Stone & Webster Engineering Corp., Boston, Mass., are suffering heavy losses from jitney competition that now exists in Dallas, El Paso, Houston, Galveston and Beaumont, where the company operates street railway lines. The interurban line that runs between Dallas and Fort Worth is now up against a competing jitney automobile service between the two cities, and jitneys are soon to be put on between Houston and Galveston and between Beaumont and Port Arthur in opposition to the interurban lines of the Stone & Webster Engineering Corp., it is announced. E. T. Moore, head of the traction companies in Dallas, states that the jitneys in that city are responsible for a loss of about $1,370 per day, which will amount to a total of $500,000 per year in the revenue of the street railway lines there. In Houston the daily loss of revenue to the street railway company on account of the jitney competition is about $1,200, and in Beaumont, Fort Worth and El Paso the loss is several hundred dollars per day for each city. In a statement of the effect of the jitney service upon the traction companies in Dallas Mr. Moore said:

"In January there were so few jitneys that their effect on the street railway company's earnings was almost negligible. For the month of February the total jitney earnings are estimated at $14,600, or an average of a little more than $500 a day. The decrease in passenger revenue of the traction company in February, 1915, as compared to February, 1914, was $31,300, but of this amount $5,000 is attributed to the corn show and $11,700 to the natural decrease due to business depression. The March figures, taken from the earning sheet of the car company, prove that the decrease in the traction receipts is growing. In March, 1914, the earnings amounted to $107,229.45, while in March 1915, the company's receipts totaled $64,745.88, showing a loss for the month of $42,483.57. According to the figures the company's receipts are this year $1,370 less per day than one year ago, or at the rate of more than $500,000 per year. A portion of this loss may be chargeable to business depression, but most of it is undoubtedly due to the jitneys."

Los Angeles Jitney Fees Reduced 50%

LOS ANGELES, CAL., April 7—The report of the finance committee recommending that the license fee for jitney buses in Los Angeles, be reduced from $15 per quarter to $7.50, was unanimously adopted. The report, constituting a $6,000 cut in the city's revenue from this class of vehicles, was a present to the city's treasurer. It was necessitated by the ruling of the city attorney that the jitney buses had been assessed under an improper interpretation of the license ordinance. The interpretation of the ordinance as to what a jitney bus really is, was asked for by the council in order to pave the way for action to compel the bus operators to conform to one standard of business and stop competing with taxicabs. Demand to this effect has been made by the taxicab concerns. The taxicabs have to pay $15 per quarter and the owners contend that if the buses engage in the taxi business, charging 75 cents an hour and upwards, the buses should be compelled to pay the same.

Another Ordinance for $5,000 Bond

ROCK ISLAND, ILL., April 9—The jitney bus business in the Tri-Cities will be given a death blow if the ordinance submitted to the city council of each should be adopted. Under its provisions, jitney bus men must deposit a $5,000 bond before embarking in business. The license fee, will be advanced from $10 per annum, as at present, to $100. Jitney bus men must present a certified map of their routes when securing permits, and will be required to adhere strictly to them. No digressions or encroachments upon other routes will be tolerated. Buses must be equipped with proper lights at night. They must operate continuously from 6 a. m. until 11 p. m. The application which must be filled out by the owner of a car, gives all particulars concerning the driver or owner, whether or not the car is paid for, the amount of property of the owner which is exempt from execution; requires references, length of residence, age, previous occupation, together with other personal information. Unless the various blanks are filled out to the satisfaction of the mayor, a permit is withheld.

Montreal's First Jitney Service Opens

MONTREAL, CAN., April 10—Next week the initial unit of the jitney bus service of Montreal will be put into operation. The first jitney bus service will include a dozen or more cars on one of the principal routes where traffic is the heaviest. This service will be operated under the auspices of the Jitney Bus Assn. of Montreal and will consist of individual car owners who are members of the association deriving benefits therefrom in payment of weekly dues just as a club member benefits by the organization. The profits from his car above his weekly dues are his own. The fare will be 5 cents and six tickets for a quarter. The plans of the jitney associations include the placing of 100 cars on the streets of Montreal before May 1.

Jitney Bus Line for Newark

NEWARK, N. J., April 13—This city will have a jitney bus line, according to a statement made recently by F. J. Griffin, promoter of the proposed local jitney system. In all likelihood there will be eight or ten routes radiating from Broad and Market streets from Park Place, those being the most congested points. No franchise is necessary, as the company will operate its buses on public hack licenses. Should traffic conditions warrant it 500 vehicles will be put into action. It is planned to carry passengers 3 miles for a nickel.

JEFFERSONVILLE, IND., April 9—The city council of Jeffersonville has decided to regulate jitney buses. The city attorney has been directed to prepare an ordinance to force every operator of a jitney bus to provide a bond of $2,500 before being permitted to engage in the business. The first jitney bus line in Dubois County has been established by Heath's garage at Huntington, Ind.

DENVER, COLO., April 5—An ordinance permitting the operation of jitney bus lines in a restricted way has just been passed by the city council of Pueblo, the only Colorado city thus far granting any jitney permits. The ordinance requires a license fee of $50, a bond of $10,000 and the filing of a draft showing the exact route to be traveled by all cars for which permits are issued. It provides further that the cars shall be allowed to stop only at alleys, that all drivers must be at least 21 years of age and that no car shall be allowed to carry more passengers than there are seats.

MILWAUKEE, WIS., April 9—Milwaukee's list of jitney buses was increased from 235 to 344 during the week ending April 10. The city treasurer reports that only 297 of the 344 who have taken out licenses have paid the $5 semi-annual fee and the chief of police has set a squad of patrolmen at work to determine how many jitneys are being operated without proper credentials. The tremendous growth of the number of jitneys is being made evident by the occurrance of accidents and the liability insurance problem is taking on a serious aspect. Insurance agents report that their home offices will not accept applications for indemnity contracts on jitney buses even at the high rate of $200 per $1,000 of liability. The question of whether or not the jitney bus is a common carrier or a public conveyance as contemplated in accident insurance policies issued to individuals has not yet been settled.

Philadelphia Jitney Bus Assn. Formed

PHILADELPHIA, PA., April 10—To forestall adverse legislation, to co-operate with the police in enforcing traffic regu-

lations and for mutual benefit, the Philadelphia Jitney Bus Assn. has been organized by the jitney bus owners in this city. The association has appointed a committee to confer with counsel to determine the legal status of the jitney. Routes of cars have been extended and definite rates of fare between certain points fixed.

There are now about 100 cars in operation, including one woman driver, who has for the past week been driving a jitney on the pay-as-you-enter system.

Plans are under way for the establishment of lines to the different baseball parks and to Fairmount Park and the 21st Ward Board of Trade has advocated the formation of a line to connect Roxborough with the City Hall, the fare to be 15 cents each way.

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WINNIPEG, MAN., April 9—It was learned today that twenty-two cars will be taken off the daily service on the streets of Winnipeg the middle of this month. About sixty employees will be thrown out of employment. The jitneys which are daily increasing in numbers are responsible for this reduction in the number of street cars.

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BALTIMORE, MD., April 10—Plans to regulate the jitney bus service in this city are being considered by the Public Service Commission. The rapid growth of the industry in Baltimore has led to W. Cabell Bruce, general counsel to the commission, being asked for an opinion as to the extent of the commission's jurisdiction in the matter. As soon as this opinion is rendered the commission will take up with the engineering department the practical phases of regulation. One of the first questions to be considered will be whether the buses will be permitted to operate only during the rush hours, paying little attention to schedule during the hours when traffic is light.

The commission also probably will decide whether more than one jitney service will be permitted to cover the same route.

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Hartford Jitneyized in 2 Weeks

HARTFORD, CONN., April 9—In less than 2 weeks Hartford has become thoroughly jitneyized. This morning there are over forty jitneys operating along the trolley lines. Friday the Capitol City Auto Co., which operates the largest fleet of taxicabs in this city, turned all its vehicles loose. In less than 1 hour 100 people were transported on Franklin avenue alone. So strong has the jitney already taken that a business house found it necessary to label a light open car, "This is not a jitney." The trolley company is wailing. The jitney operators make their stops at the trolley terminals and have no trouble in picking up a good load. A car designed for seven passengers is carrying twelve and fourteen persons. The drivers are making an average of from $12 to $15 a day. The trolley company wants special legislation for the control of the jitneys.

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CAMDEN, N. J., April 10—So rapidly has the jitney craze grown that the City Council is considering the advisability of assessing a license fee of $35 on each car in addition to providing for their regulation. Such action on the part of the City Councilmen, however, is being strenuously opposed by the general public on account of the popularity of the little bus.

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WASHINGTON, D. C., April 13—Conrad Syme, corporation counsel of this city, who is making an extended tour of the country studying the jitney bus situation, has sent a report to the commissioners on his observations in New Orleans. He says the jitney bus has come to New Orleans to stay and that Washington offers as favorable an opportunity for its operation as the Southern city.

"The desire is strong here," said Syme in his New Orleans report, "to have the jitneys confined to certain routes. I think this will be difficult and that so far as jitneys run by individual owners or operators are concerned they should and will only be confined to the routes indicated on the card. The regular jitney bus lines, with regular cars carrying about 20 persons, will probably desire defined routes. It seems very essential that each car should display on the interior the name and number of the owner or operator, so as readily to identify the same in case of accident. There are in New Orleans about 400 individually owned jitneys, comprising cars of all types. There is also a jitney mobile line of 6 or 8 cars, capacity 20, going over a regular route of 2 1-2 miles long. The individual jitneys are licensed at $30 per year. They are not publicly regulated as to routes."

Oklahoma 2-Day Meet April 20-22

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To Make Race an Annual Affair—Raise Fund of $10,000 —Grandstand for 15,000 Planned

OKLAHOMA City, Okla., April 9—With practically every detail now in the hands of various committees and nearing completion, the 2-day automobile race meet to be held here April 20-22 under the auspices of the Southwest Auto Racing Assn. now gives promise of being a success. Members of the association are raising a fund of $10,000 to put Oklahoma on the gasoline map.

Officers of the association are: E. R. Carhart, Oklahoma City, president; J. T. Rutherford, vice-president; J. P. Brough, secretary; C. W. Boggs, treasurer. Directors: Joseph Huckins, Jr., B. F. Burwell, J. B. Burwell, Harry Baker and Charles Knight, all of Oklahoma City, and John Kroutil, Yukon.

For the 200-mile race to be held April 22 for a purse of $5,000 with a $1,000 bonus for a new world's record, entries to date are as follows:

Barney Oldfield, Maxwell; Billy Carlson, Maxwell; Earl Cooper, Stutz; Dave Lewis, Stutz; Bob Burman, Peugeot; Louis Disbrow, Simplex; Eddie Hearne, Case; another Case whose driver has not yet been announced; Elbert Strigel, Stafford; George Clark, Mercedes; and A. F. Scott, Tulsa.

For the 99-mile race to be held April 20 for a purse of $1,000 and the silver trophy donated by the Chamber of Commerce, entries are:

Earl N. Swan, Knox; C. L. McLester, Franklin; Jake Strickler, Buick; J. B. Chandler, Buick; J. Roy Sloan, Overland; M. J. Main, Mercer; Paige-Detroit, whose driver has not yet been announced; Roy G. Thomas, Weston; and Charles Schaffstall, Studebaker.

It is planned by the association to make the races an annual affair and for this reason the 2.409-mile course is being worked into the best condition possible. That portion of Linwood boulevard which comprises a part of the track is being resurfaced. The turns on the track have been banked with a 10 per cent. grade and experts say that a speed of from 40 to 50 miles an hour will be possible without danger to the drivers.

Practice on the race course will begin April 14, a week before the first day's program. The practice will be limited to 2 hours a day and will be held from 6 to 8 o'clock each morning at which time the entire course will be patrolled by special guards. Foot bridges are being constructed over the track in order that there may be no liability of school children being injured while crossing the track during the races.

Local contractors are building a grandstand to accommodate 15,000 people.

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3 Stutz and 1 Bugatti Enter 500-Mile Race

INDIANAPOLIS, IND., April 9—Three Stutz cars have been added to the field in the next Indianapolis 500-mile race, raising the total of entries for that event to fifteen.

Barney Oldfield will drive George Fuller's Bugatti in the race. Fuller's car was driven in the Vanderbilt Cup and grand prix races at San Francisco and in the Venice race, March 17, where it finished fourth, by J. B. Marquis. Marquis is the driver who turned over in the Sunbeam in the 1914 Grand Prix, on the Santa Monica course.

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DETROIT, MICH., April 8—The first sod for the proposed Detroit motor speedway at Sibley, Mich., was turned this afternoon.

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Two Speedways Promised for St. Paul

ST. PAUL, MINN., April 9—This city is again promised two automobile speedways. This comes about through the incorporation today of the Twin City Motor Speedway Co. by H. E. Habighorst, C. W. Van Orsdol and J. F. Sperry. The capital is $1,000,000. These three men were formerly part of the Twin City Motor Speedway Assn., a rival of the Minnesota Motor Speedway Assn., which two organizations a week ago were said to have reached an agreement whereby there was to be only one speedway plan and only one track,

when originally each organization announced it would have a speedway somewhere between St. Paul and Minneapolis.

Then more complications arose, with each side claiming it was to be the surviving organization. Out of this tangle comes the incorporation of the Twin City Motor Speedway Co., backed by the above men, who were associated with W. D. and J. D. Hogan, Minneapolis; Dr. C. E. Dutton, Minneapolis, and F. H Wheeler, Indianapolis, in the Twin City Motor Speedway Assn.

H. C. Moore, fiscal agent for the Minnesota Motor Speedway Assn., stated that final financial arrangements had been made for his company to remain in the field and build a speedway on the site near Lake Josephine, as the original intention of the organization.

The site on which the Twin City Motor Speedway Co. states it will build a track is conveniently situated between St. Paul and Minneapolis, farther south than the Lake Josephine site of the other concern. This track, it is said, will be completed in time for races expected to be held next Labor day.

Cincinnati Motor Speedway Co. Formed

CINCINNATI, O., April 12—Talk of a local track which has been going on for some time has resulted in the formation of the Cincinnati Motor Speedway Co., which purposes to construct a 2 1-2-mile speedway which also will include the usual country club idea.

The organization meeting was held Friday at the Business Men's Club and was presided over by Dr. Charles L. Bonifield, president of the Cincinnati Automobile Club. It was decided to form a stock company with a capitalization of $5,000, and seven directors were elected. E. W. Edwards, president of the Edwards Mfg. Co., and former president of the Business Men's Club, was chosen president. Among the other officers are James P. Orr of the Potter Shoe Co., Julius Freiberg of the Freiberg Realty Co., Andreas Burkhardt of the Burkhardt Co., and George Balch of the Sinton Hotel Co. All these men belong to the progressive element of the city and their names undoubtedly will inspire confidence in the project.

While the Cincinnati Automobile Club as an organization may not be actively identified with the scheme, yet Dr. Bonifield declares that he expects every one of its fifteen members of the board of governors will take stock and assist individually.

Options have been secured on several good tracts of land, but the final decision is up to the board of directors. One that is favored is on the Reading road, which is one of the main highways leading out of Cincinnati. It starts near the court house and leads up a valley to the hill-top, where it becomes the main street of Avondale, one of the most fashionable suburbs. From there it runs through Reading and on to Lebanon, where it connects with another pike leading to Dayton. The Big Four Railroad from Cleveland and Columbus passes the proposed site, while the Chicago branch of the Pennsylvania is very near it.

Steel—Its Pathology—Part II

(*Continued from page* 663)

find a combination of two alloys which in themselves are often classed as an impurity on the part of the silicon and a medicine for the manganese. Yet when used in the proper proportions the hardening effect of the silicon and the purifying effects of the manganese, which also neutralizes in part the effect of the silicon, results in a steel that, when properly heat-treated, forms one of the best spring steels known. The composition of a sample silico-manganese spring steel is from 1.5 to 2 per cent. silicon, from .50 to .80 manganese and from .45 to .55 carbon. Beyond 1 per cent. an increase of manganese seriously affects the ductility of the metal, but the neutralizing effects of the silicon render the resulting structure one which is admirably adapted to take the heat treatment necessary to produce a spring.

Robert Hadfield, a noted metallurgist, is responsible to a large degree for the use of manganese steel. The special steel he evolved contains about 13 per cent. of manganese and 1 per cent. of carbon. As would be expected from the knowledge that manganese is a great hardening agent this steel will be hard whatever shortcomings it may have. This is indeed the case, but in addition to its hardness, when used as a casting the steel is very strong and tough and has to be somewhat softened by a heat-treating process. The extreme hardness of the product renders it practically impossible to be machined and as a result it is only used in such positions as rock-crushing apparatus and similar work where extreme hardness and resistance to wear are demanded.

Titanium a Deoxidizer

Titanium is another of the elements which occur very widely and abundantly in nature and which are often found in the iron as it comes from the mines. There is a great deal of uncertainty among metal experts as to what the true effects of titanium really are. Its principal use is as a deoxidizing agent and most authorities claim that when sufficent has been added to react with the oxygen and nitrogen present it has no further effect. Its property as a nitrogen remover due to its strong affinity for that gas makes it very valuable in iron work. It is added to cast iron quite frequently for the purpose of removing to a large extent the danger of blowholes. Titanium is not an old alloy, having been isolated only as lately as 1895. It is one of the few elements which readily unites with nitrogen and is very peculiar in that when its oxide is heated in an atmosphere of nitrogen in an electric furnace the resulting product is a bronze-yellow mass, which is titanium itself, practically as hard as a diamond. It is one of the rather uncertain medicines which the doctor of steel has at his disposal and at the present time many experiments are being conducted with a view of showing its exact effects in different directions.

Molybdenum is a hardener like tungsten and its effects are very similar to those of the latter except that they are more pronounced. Prominent metallurgists assert that molybdenum has 4.5 times the results of tungsten and when used in this proportion can be substituted in the ratio of 1 per cent. for every 4.5 per cent. that would be used of tungsten. This strangely follows through not only the high speed tool use but also for permanent magnets, although while it is claimed that for the latter use it is even better than tungsten, our large magneto manufacturers hold closely to the tungsten.

These alloys form the basis of special steel practice as it applies to the principal industries today. To sum up:

We have nickel, the increaser of the elastic limit, hardness and ductility. It is the muscle and vitality builder.

Chromium, the bone-builder, allows a hard steel to resist great shocks.

Vanadium the vitalizer, allows steel to resist fatigue.

Silicon a hardener, which ordinarily seriously affects the strength, but, when purified by manganese forms a great spring steel.

Aluminum is a deoxidizer.

Titanium also removes the oxygen besides combining with the nitrogen.

Tungsten is the great hardener, and retainer of magnetism.

Molybdenum is also a hardener and a retainer of magnetism, forming what may be called the understudy of tungsten. It also enables steel to resist rusting.

Four-Cylinder Ingot to Enter Field

CALUMET, MICH., April 12—A four-cylinder touring car, to be known as the Ingot, is to be made either in this city or in Houghton. The new concern intends to make the price of its car between $700 and $1,000 and employ 200 men the first year. The car will be assembled, the parts and accessories to be purchased principally in Detroit.

Factory Miscellany

DOUBLE-TREAD Tire's Factory—The Double-Tread Tire Co., of Indiana, Indianapolis, Ind., has established salesrooms and a factory at 609 North Illinois street. The company was recently incorporated under the laws of Indiana for the reclamation and reconstruction of automobile casings. B. E. Griffey and J. A. Gavin are backing the new company. In the reclamation process, or "economy system process," two old casings are utilized to make one casing. Tread-worn, rim-cut, blown-out casings which are no longer of service are combined. A casing with a good bead and side wall is repaired and strengthened so as to hold the inner tube; another with a fair tread is put over it. The bead is trimmed and the two are lock-stitched together. Two rows of stitches, made with a heavy gum-treated flax cord, hold the two casings beyond the possibility of slipping, and at the same time make a water and dustproof seam. The double-tread casing produced is practically puncture and blow-out proof. Officers of the company say it is serviceable for from 2,500 to 10,000 miles, according to the condition of the casings reclaimed.

Tire Factory for Fort Madison—The Perfection Tire & Rubber Co. will establish a factory in Fort Madison, Ia.

Winton Doubling Time—The Winton Motor Car Co., Cleveland, O., employing 2,000 workmen, has started day and night shifts.

Galion to Add—The Galion Motor Car Co., Galion, O. (E. P. Rayl, proprietor), is preparing to make a 50 by 150-foot addition to its plant.

Plant for Connolly Co.—Plans have been prepared for the construction of a 50 by 120-foot concrete plant for the Connolly Motor Co., Mandan, N. D.

Drednot Truck's Plant—The Drednot Motor Truck Co., Ltd., Montreal, Que., has secured a factory at Wellington and Nazareth streets, and will install machinery.

Victor Rubber Adds—The Victor Rubber Co., Springfield, O., has awarded a contract for adding a second story to the addition to the plant now under construction.

Ford Factory in Charlotte—The Ford Motor Co., Detroit, Mich., will build a factory in Charlotte, N. C., to cost about $250,000. The plant will employ about 2,000 men and will be ready for business in about a year.

Columbus Buggy Sells Shop—The Columbus Buggy Co., Columbus, O., has disposed of the one-story building used as a blacksmith shop to the Corrugated Container Corp. of New York City, which will use it to manufacture containers.

Perfection Tire's $90,000 Plant—The Perfection Tire & Rubber Co., of Chicago, will build a factory at Ft. Madison, Ia. The buildings and equipment will represent an outlay of about $90,000. It is the intention to have the plant in operation by the last of July.

Working on Swinehart Addition—The work of constructing a three-story office building and factory by the Swinehart Tire & Rubber Co., Akron, O., has begun. The addition is being erected on North street, in the rear of the present buildings. The cost will be in the neighborhood of $50,000.

Packard's Three-Story Addition—The Packard Motor Car Co., Detroit, Mich., will build a three-story addition to its plant on Concord avenue. The structure will be 52 by 113 feet in size and of reinforced concrete. It will cost about $10,000 and become the heat-treating department. In the main building the show or display room will be completely altered at an expense of $5,000.

Republic Payroll Largest in Its History—This week there were 200 men on the pay-roll of the Republic Motor Truck Co., Alma, Mich., the largest number in the history of the company. This force will be increased to 250 or 300 by the end of May. Orders in March were 60 per cent. over those received in April and more than triple the number received last year in March.

Baker to Increase Production—The Baker Motor Vehicle Co., Cleveland, O., which recently reduced the prices on three of its models, will greatly enlarge the scale of production on its light electric coupé. By concentrating upon this model and producing it in quantities never before undertaken, the company has reduced the manufacturing expense, as well as the general expense per car.

Studebaker Plant Has Over 1,000,000 Sq. Ft.—According to a very recent investigation the total floor space of the different plants of the Studebaker Corp., Detroit, Mich., and in South Bend, Ind., is 1,500,000 square feet. At the South Bend plant the motor castings, springs, several small castings and complete bodies are made. At the foundry 160,000 pounds of castings are produced daily, also 90,000 sets of springs.

Figures on E-M-F and Flanders Production—The total number of E-M-F 30, Flanders 20 and Studebaker cars, which had been made and sold up to July 1, 1914, was 134,023. The first two named cars were made by concerns which were taken over by the Studebaker Corp., Detroit, Mich. In 1913 the Studebaker cars made totaled 34,107. During the first 6 months of 1914 the production totaled 19,809; and while the total figure for the year is not yet known, it is estimated at over 40,000.

Ohio Convicts Build Trucks—Five new 3-ton trucks have been finished at the Ohio penitentiary, Columbus, O., by convict labor. The trucks are to be used in the state service at the various institutions. A year ago the convicts of the state prison turned out their first truck, which proved a big success. The prisoners have started to work on five additional trucks. It is claimed that they have cost $1,000 less each than could be purchased from manufacturers.

Work Begun on Truck Factory—Active operations were begun on the new plant of the Beech Creek Truck & Automobile Co., Beech Creek, Pa. The industry will be located on East Main street. The company has also made arrangements to purchase 10 acres in addition to the 4 acres. The first building to be erected is the office and draughting room combined, in all 12 by 22 feet, facing the street Next week work will begin on the construction of the first building, 30 by 60 feet. P. J. Smith, the inventor of the new type of four-wheel drive trucks, and the superintendent and general manager of the company, arrived there from a business trip to Pittsburgh and Buffalo, where he acquired the necessary machinery and tools with which to equip the plant to begin active operations.

Mt. Wolf's Automobile Plant—York county, Pa., will have another automobile manufacturing plant. The plant will be known as the Mt. Wolf Motor Car Co. and will be located at Mt. Wolf, about 8 miles northwest of York. Several meetings of stock subscribers and interested persons have been held and a site for the factory is now being considered. The company will be incorporated at $50,000, later to be increased to $150,000. The proposed new plant will start operations with about fifty men, the number to be increased as the business warrants it. The plant will devote its attention to the manufacture of touring as well as commercial cars. A new device that will be tried out, according to plans, will be the construction of a touring car with a detachable body, which, when the body is removed, can be converted into a car for commercial use. The plant will be under the management of J. C. Krout.

The Automobile Calendar

April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla. Road Race, S. W. Auto Racing Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

The Week in  the Industry

Motor Men in New Roles

ANDREW Joins Remy—F. W. Andrew, formerly designing engineer for the Dayton Engineering Laboratories Co., Dayton, O., has affiliated with the engineering staff of the Remy Electric Co.

Needham Jeffery Advertising Mgr.—M. H. Needham has been appointed advertising manager of the Thomas B. Jeffery Co., Kenosha, Wis.

Howell J-M Advertising Mgr.—A. R. Howell has been appointed advertising manager of the H. W. Johns-Manville Co., New York City, succeeding F. J. Low, who has resigned.

Seibert Studebaker Mgr.—C. K. Seibert, formerly auditor of the Studebaker Corp., South Bend, Ind., has been appointed acting manager of the Studebaker branch at Salt Lake City.

Moore Appointed Mgr.—North Moore has been appointed manager of the Trenton Motor Co., St. Louis, Mo., Mercer distributor. He succeeds J. L. Nugent, who has resigned on account of poor health.

Dill N. J. Automobile Commissioner—W. L. Dill, of Paterson, N. J., has been appointed Commissioner of Motor Vehicles of New Jersey to succeed Job. H. Lippincott. He will also act as Assistant Secretary of State.

Gerspacher Overland Mgr.—C. G. Gerspacher, formerly assistant manager of the Omaha (Neb.) branch of the Studebaker Corp., has resigned, to take the position of manager for E. A. Brandes, Overland distributor of Overland cars in Hastings, Neb.

Messinger Republic Truck Mgr.—C. J. Messinger, long associated with the automobile business in Tacoma, has assumed the sales management of the Republic truck department of the Griffith Motor Car Co., which is also Tacoma, Wash., distributor for the Dodge cars.

Morse Representing Grossman—E. H. Morse has been engaged to represent the Emil Grossman Mfg. Co., Inc., New York City, among manufacturers in the territory west of Michigan, including Indiana. Mr. Morse recently conducted a car agency and supply house in Providence, R. I.

Haggerty Succeeds Earle—W. E. Earle, manager of the Indianapolis branch of the Ajax-Grieb Rubber Co., has been succeeded by C. J. Haggerty, of Brooklyn, N. Y., who has assumed his new duties. Mr. Earle has been transferred to the New England States, where he will travel.

Matheson Dodge Service Mgr.—C. M. Matheson, until recently New York district representative of Dodge Bros., Detroit, Mich., has been appointed manager of the concern's service department, with headquarters in Detroit. Mr. Matheson was formerly president of the Matheson Motor Car Co.

Harrison Chalmers Advertising Mgr.—J. R. Harrison has been appointed advertising manager of the Chalmers Motor Co., Detroit, Mich., succeeding Newton A. Fuessle, who resigned owing to ill health. Mr. Harrison comes from the Burroughs Adding Machine Co., where he has been assistant advertising manager during the last year and one-half. Previous to that connection he was with the National Cash Register Co., Dayton, O., being confidential secretary to Lee E. Olwell, who now is general manager of the Chalmers company. Before going to Dayton, Mr. Harrison was in the advertising business in Chicago.

Recent Premier Changes—J. E. Levi, of the Premier Motor Manufacturing Co., Indianapolis, Ind., in addition to his southern territory, will cover the states of Montana, Idaho, Wyoming, Utah, Colorado, Arizona and New Mexico. J. B. Dub, formerly in the southwest for Premier, is now located in the east for this company, with headquarters in New York City. C. I. Lowd has been appointed factory representative for the company in New England. He makes his headquarters with the Premier Boston dealers, the Premier Motor Co., 885 Boyleston street. E. E. White has been appointed purchasing agent for the company. E. E. Westman, late purchasing agent for Premier, takes charge of the Premier technical department.

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Garage and Dealers' Field

New Detroit Accessory Store—H. S. Wagnits has opened an automobile supply and accessory store at 680 Woodward avenue, Detroit, Mich.

Warner Gear's Detroit Branch Moves—The Detroit branch office of the Warner Gear Co., Muncie, Ind., has been moved from the Ford Bldg. to 967 Woodward avenue.

Royal Equipment in New Office—The Royal Equipment Co., maker of Raybestos brake linings, clutch discs and linings, etc., is located in its new office, 1613 Dime Bank Bldg., Detroit, Mich.

New Garage in Santiago—Pancorvo Bros., commission merchants, exporters and importers in Santiago, Chili, and with offices at 17 Battery Place, New York City, recently built a fireproof garage in the South American city, with a capacity for 200 cars.

Detroit Westinghouse Moves — The Detroit, Mich., offices and service station of the Westinghouse Electric & Mfg. Co. has moved into its new quarters at 1211 Woodward avenue. A complete stock of repair parts for the various Westinghouse products is kept in stock.

Opens New Garage—J. P. Muller, president of the advertising company bearing his name in New York City, has incorporated the Thoroughfare Garage Co., Inc., of Elmhurst, L. I., which on April 1 opened a fireproof brick and concrete garage at Queens and Paris boulevards, that city.

Krit's New Detroit Service Dept.—The service department of the Krit Motor Car Co., Detroit, Mich., is now located at 584 Franklin street, which is also the service station for the cars made by the following concerns, all of which are now bankrupt: American Voiturette Co., Henderson Motor Car Co., Michigan Motor Car Co.

Right Shock Absorber in Minneapolis—The Kleckner Shock Absorber Co. has taken over the distribution of the Right shock absorber for the states of Minnesota, North and South Dakota. Its headquarters are at 1514 Hennepin avenue, Minneapolis, Minn. The Right shock absorber is a special shock absorber for medium-weight cars.

Baltimore's New Tire Shop—The Tire Shop, according to an announcement made, is the successor to Eldred B. Quarles & Co., Charles and 20th streets, Baltimore, Md. Those interested in the Tire Shop are W. C. Floyd and W. Rydstrom. In addition to the Dayton airless tires and the Braender tires, it is announced that the Shop will carry Batavia tires.

Handles Silver's Used Car Business—All the used cars taken in trade by the C. T. Silver Motor Co., New York City, distributor for the Overland and Peerless cars, will be handled by the Rodney K. Haines Co., that city. The company has the exclusive agency for all used cars taken in trade by the Silver company. Salesrooms have been opened at 1739 Broadway.

Accessory Branch for Colorado Springs — R. I. Lemon, for the last 4 years connected with the MacFarland Auto Co., of Denver, Colo., and Wyoming distributor for the Buick and Packard cars, has gone to Colorado Springs and opened an accessory store under the name of the Colorado Springs Auto Equipment Co., a branch of the Denver Auto Equipment Co.

Locomobile Used-Car Sale—The New England branch of the Locomobile Co. of America inaugurated a Spring sale this week at its salesrooms in Boston, Mass., that is being watched with interest by the other dealers. The quarters will be kept open from 8.30 a. m. to 10 p. m. every day from Monday to Saturday, and advertisements in the newspapers call attention to the sale of cars taken in exchange for new Locomobiles. While Locomobiles are the feature of the sale, other cars will also be sold. The keeping open of salesrooms on Commonwealth avenue until 10 at night for an entire week for the sale of used cars is an innovation.

New Autocar Service Station—The Autocar Sales Co., New York City, has opened its new truck garage and service station at 557 West Twenty-third street. The building is of fireproof construction throughout and runs from Twenty-third to Twenty-fourth street, where are located the main garage entrances and exits. The sales and show rooms are at the Twenty-third street front, and the entire rear of the ground floor of the building is given over to garaging space. On the second floor are the road service department, which maintains spare cars for rental to owners for emergency haulage; completely equipped repair shops, offices and stockrooms.

Automobile Agencies Recently Established

PLEASURE CARS

Arkansas

Bentonville	Metz	H. S. Hess

California

Glendale	Oldsmobile	E. Bennett, Jr.
Isleton	Oldsmobile	C. K. Cook, Netherland Garage
Los Angeles	Moline-Knight	Moline Automobile Co.

Colorado

Berthoud	Grant	Berthoud Garage Co.
Coaldale	Chevrolet	Phillip & Perry
Coaldale	Monroe	Phillip & Perry
Colo. Springs	Pilot	W. W. Price
Denver	Haynes	E. J. Johnson
Denver	Hercules	South Denver Garage Co.
Denver	Dort	J. S. Morrison Auto Co.
Denver	Hupmobile	J. S. Morrison Auto Co.
Denver	Chandler	A. T. Wilson Auto Co.
Denver	Pilot	Elmore Auto Co.
Fort Collins	Chevrolet	Ben Mosman
Fort Collins	Monroe	Ben Mosman
Greeley	Hupmobile	Schoonmaker & Lee Bros. Hdw. Co.
Montrose	Pilot	J. Hodges
Pueblo	Pilot	E. I. Crockett
Trinidad	Moline-Knight	D. H. Gottlieb

Connecticut

Danbury	King	A. C. Penny
Derby	King	W. C. Gilbert
Hartford	Pilot	J. J. Molloy
New Haven	King	W. R. Moore
Shelton	Pilot	H. L. Stilphen

Illinois

Aurora	Moline-Knight	Sprinkel & Bromley
Aurora	Pilot	E. J. Ellie
Bushnell	Moline-Knight	S. H. Robinston
Bushnell	Oldsmobile	D. B. Carithers
Cambridge	Moline-Knight	P. A. Johnson
Chicago	Chevrolet	Chev. Motor Co. of Ill.
Chicago	Moline-Knight	The Austin Garage
Chicago	Moline-Knight	Moline Auto Co.
Dixon	Kissel	R. Nelson
Farmington	Moline-Knight	C. A. Negley
Freeport	Moline-Knight	G. W. Brokhausen Automobile Co.
Freeport	Franklin	D. E. Sunderland
Forreston	Moline-Knight	Abels & Korf
Galena	Moline-Knight	K. V. Johnson
Hillsdale	Moline-Knight	J. F. Butzer & Son
Joliet	Moline-Knight	Long Bros.
La Salle	Dort	J. E. McCabe
La Harpe	Pilot	B. N. Byler
London Mills	Moline-Knight	White, Latourette & Sampson
Milledgeville	Dort	E. C. Miller
Morton	Moline-Knight	H. F. Zelle
Murphysboro	Pilot	G. E. Craine
New Boston	Moline-Knight	D. S. Prentiss
Peoria	Moline-Knight	J. E. Whitten
Ransom	Moline-Knight	Richards & Weber
Rock Island	Moline-Knight	Sauermann Motor Co.
Springfield	Moline-Knight	Seidler & Keener
Tuscola	Pilot	F. Wilson
Wyoming	Moline-Knight	S. Wilkinson

Indiana

Elkhart	Chevrolet	W. H. Keeth, Jr.
Evansville	Chevrolet	Fuchs & Angermier
Farmland	Oldsmobile	Earl Burnworth
Fort Wayne	Oldsmobile	Shryock Auto Co.
Hartford City	Oldsmobile	A. W. Tindall
Huntington	Pilot	D. E. Lauferty
Indianapolis	Scripps-Booth	E. H. Wilson
Indianapolis	Oldsmobile	Wildhack Co.
Logansport	Pilot	J. I. Barnes
Marion	Chevrolet	J. V. Shugart
Monon	Pilot	H. B. Rull
Muncie	Oldsmobile	Bowman & Shaffer Sales Co.
North Vernon	Pilot	Litchfield Bros.
Seymour	Oldsmobile	H. Chambers
Terre Haute	Oldsmobile	Miller & Stein
Tipton	Pilot	F. U. Campbell
Vincennes	Pilot	J. C. Hellert
Waynetown	Oldsmobile	C. A. Snyder & Son

Iowa

Avoca	Moline-Knight	Wm. Pratt
Carroll	Enger	Carroll Motor Co.
Carroll	Carter	Carroll Motor Co.
Cedar Rapids	Kissel	KisselKar Co.
Cedar Rapids	Moline-Knight	J. A. Wicke
Cherokee	Moline-Knight	Lamont Bros.
Clinton	Moline-Knight	Model Auto Co.
Des Moines	Chevrolet	W. A. Oldfield
Durant	Moline-Knight	A. F. Schiele
Dysart	Moline-Knight	Dysart Motor Co.
Fort Dodge	Dort	Hansen & Tyler Auto Co.
Ida Grove	Kissel	J. M. Rees
Kalona	Moline-Knight	Louck & Boehme
Leon	Metz	C. Snyder
Manning	Moline-Knight	Herman Gotch
Mason City	Dort	Snyder & McCall
Modale	Metz	Southside Garage
Sioux City	Grant	J. W. Ohlman
Sioux Falls	Kissel	Levitt & Reiley
Tama	Moline-Knight	Grau & McKeen
Tama	Dort	Grau-McKeen Co.
Tipton	Moline-Knight	Barcley & Smith
Van Horn	Moline-Knight	E. J. Woltersdorf
Villisca	Haynes	H. C. Evans
Washington	Pilot	J. E. Griffith
Waterloo	Dort	Burd Auto & S. Co.
Waterloo	Moline-Knight	C. Bixler

Kansas

Concordia	Oldsmobile	H. L. Austin
Ford	Oldsmobile	D. C. Cook
Topeka	Regal	Independent Auto Co.
Topeka	Marmon	Independent Auto Co.
Topeka	Chandler	Independent Auto Co.

Kentucky

Duckers Station	Pilot	J. D. Smith
Shelbyville	Oldsmobile	Sol Hopkins

Louisiana

New Orleans	Oakland	Canal Auto Co.

Maine

Caribou	Pilot	Pitcher & Briggs
Portland	Scripps-Booth	Franklin Motor Car Co.

Massachusetts

Boston	Pilot	Johnson-Hayes Co.
Boston	Moline-Knight	H. Turner
Great Barrington	Kissel	Conolly & Minard
Haverhill	Moline-Knight	Renton Motor Car Co.
Littletoncommon	Pilot	Thomas Moore
Lynn	Haynes	F. L. Witherell
Pittsfield	Ford	F. A. Minkler
Salem	Kissel	C. W. Williams
Somerville	Pilot	E. O. Hayes
Springfield	Reo	Reo Springfield Co.
Waltham	Metz	Metz Automobile Co.

Michigan

Blissfield	Dort	Hass & Hill
Clare	Chevrolet	J. T. Brown & Son
Davison	Dort	Downer & Fairchild
Detroit	Ross	McKenney-Devlin Co.
Detroit	Chandler	Gordon Auto Sales Co.
Evart	Dort	Sanberg & Allison
Fenton	Dort	J. H. Cox
Flint	Chevrolet	C. T. Mines
Flint	Chevrolet	Flint Patter & F'dry Co.
Greenville	Maxwell	Hansen & Lyman
Houghton	Pilot	E. Mili
Jackson	Hollier	H. B. Crosier
Lennon	Dort	W. L. Cozadd & Co.
Marcellus	Dort	King & Goodes
Milford	Chevrolet	T. H. Padley
Manistee	Chevrolet	National Garage & Sales Co.
North Star	Dort	F. N. Selby
Portland	Dort	Barton Bros.
Redford	Dort	H. A. & G. A. Miller
Saginaw	Dodge	E. L. Black
Stockbridge	Dodge	Wilbur Ostrander and Casper Glenn
Washington	Chevrolet	Wright & Haughton
Williamston	Dort	G. W. Akers

Minnesota

Minneapolis	Chevrolet	Minnesota Motor Car Co.
Minneapolis	Dort	La Crosse Implement Co.
New Ulm	Kissel	E. H. Retzlaff
Stillwater	Oldsmobile	L. C. Kriesel

Missouri

California	Moline-Knight	W. Kuhlmann
Kansas City	Chevrolet	W. S. Hathaway Motor Co.
Kansas City	Milburn	Electric Car Sales Co.
Kansas City	Regal	Myers-Ebersole-Motors Co.
Nevada	Pilot	W. F. Norman
St. Louis	Argo	Weber Implement & Auto Co.
Springfield	Chevrolet	Vandell Motor Co.

Montana

Brookville	Pilot	A. C. Miller & Co.

Nebraska

Albion	Haynes	J. H. Moore
Alliance	Haynes	H. . Ellis
Ashland	Metz	W. A. Fowler
Bancroft	Metz	J. H. Munderlon
Bencroft	Metz	T. E. Tighe
Bartley	Grant	L. A. Russell
Callaway	Metz	H. Ridder
David City	Grant	E. D. Cuckler
Fremont	Grant	Zapp Auto Co.
Grand Island	Grant	J. P. Dugan
Hastings	Grant	Stephen Schultz
Hastings	Haynes	W. J. Swanson
Holdrege	Grant	Lyle & H. Young
Humphrey	Grant	H. J. Breunig
Lincoln	Grant	P. W. Rathbun
Louisville	Carter	A. R. Standar
Merna	Carter	C. Hipsley
Norfolk	Auburn	Paswalk Co.
Norfolk	Metz	Wilson Bull Tractor Co.
Omaha	Moline-Knight	Moline Automobile Co.
Ord	Grant	F. Beran
Osceola	Grant	C. E. Hansen
Paxton	Cartercar	F. L. Burt
Plymouth	Metz	A. W. Weichel
Polk	Grant	R. H. Thesing
Prague	Grant	J. Pabian
Ravenna	Grant	R. Harrington
Rulo	Metz	F. Winterbottom
Seward	Metz	H. A. Hershberger
Stamford	Grant	D. Elder
Stanton	Grant	G. Lund
Stanton	Moline-Knight	J. R. Stucker
Swedeburg	Grant	A. J. Olson
Trenton	Grant	A. H. French

Nevada

Reno	Pilot	C. P. Burns

New Hampshire

Dover	Pullman	G. O. Athonre
Newport	Fort	Kidder Garage Co.

New Jersey

Collingswood	Pilot	J. T. Monaghan
High Bridge	King	G. H. Cramer
Jersey City	King	W. H. Dykeman
Newark	King	Stutz Motor Car Co., Inc.
Perth Amboy	King	Perth Amboy Hardware Co.
Trenton	King	J. R. McCardell & Co.
Westfield	King	Abrams & Sheild

New Mexico

Santa Fe	Pilot	N. Salmon

New York

Brooklyn	Pilot	J. S. Frazee
Canajoharie	Pilot	W. J. Woser
Corinth	Pilot	J. I. Johnson
Dobbs Ferry	Pilot	P. J. Carpenter, Jr.
Elmont	King	Hoeffner's Garage
Far Rockaway	Dort	J. M. JGarage, Inc.
Ferndale	Pilot	M. M. Schulz
Flushing	King	J. H. Seager
Katonah	King	Dickinson's Garage
La Grangeville	Pilot	W. J. Northrup, Jr.
Manchester	Stutz	E. Reed
New York	Pilot	J. E. Kunkely
Olean	Dort	Mazza & Questa
Olean	Kissel	Lester & Thomas
Plattsburgh	Pilot	J. A. Lynch
Poughkeepsie	King	H. Sague & Son
Quogue	King	Louis Muley
Rochester	Moline-Knight	C. H. Washburne

North Dakota

Cando	Franklin	Bonawitz & Tallman

Ohio

Ashland	Buick	Topping's Fireproof Garage
Bowerstown	Buick	W. B. Penn Co.
Cenfield	Buick	C. S. Dodd
Cleveland	Chevrolet	Hamilton Motor Car Co.
Cleveland	Carter	Cartercar Sales Co.
Cleveland	Pierce-Arrow	Weaver-Brownlee
Cleveland	Kissel	Eiseman Auto Co.
Clyde	Kissel	W. A. Roush & Son
Columbus	Chevrolet	Winders Motor Sales Co.
Coshocton	Haynes	Fifth St. Garage
Delaware	Ford	J. J. Neville
Delaware	Buick	J. J. Neville
Eaton	Chevrolet	S. Browet
Frazerburg	Buick	A. T. Wood
Huron	Dort	G. E. Rhinemiller
Lodi	Buick	Sanford & Hahn
London	Buick	E. P. Chenoweth
Mt. Gilead	Buick	Wilson & Bradford
Mt. Gilead	Franklin	H. B. Wood
Mt. Vernon	Buick	Sapp Bros. & Ward
New Concord	Buick	J. H. McKinney
Norwich	Buick	W. C. Guyer
Oberlin	Buick	L. B. Williams
Toledo	Dort	Francke Motor Sales Co.
Toledo	Chevrolet	Bunnell Auto Sales Co.
Uniontown	Oldsmobile	C. A. Bodemar
Warren	Buick	W. H. Marsh
Warsaw	Buick	E. M Wright

Oregon

Portland	Chevrolet	Northwest Chev. Moto Car Co.

Pennsylvania

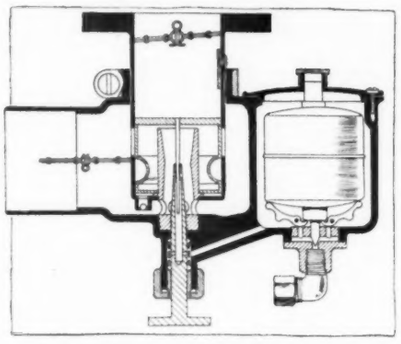
Butler	Chevrolet	C. & L. Motor Co.
Indiana	Chevrolet	W. Stewart
Lancaster	Kissel	W. S. Baker
Reading	Dort	Lance 3rd Commercial Car Co.
Scranton	Kissel	Central Auto Co.
Washington	Dort	Wylie Ave. Auto Co.

Rhode Island

Providence	Munroe	Longley Motor Sales Co.
Providence	Moline-Knight	G. F. Cook

ACCESSORIES

THE Brad-Kent carbureter is a simple pattern of automatic instrument designed with particular thought as to the requirements of the Ford car motor. As can be seen from the sectional view, there is a venturi with a central jet, and a metering pin partly closes the nozzle. Surrounding the venturi is an annular piston which uncovers eight square air ports as it rises, the piston being pierced with holes to correspond to these ports. Air

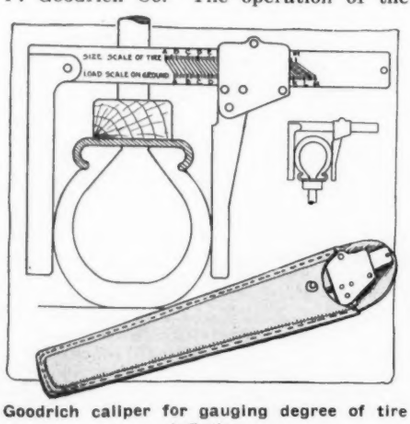


Section through Brad-Kent carbureter

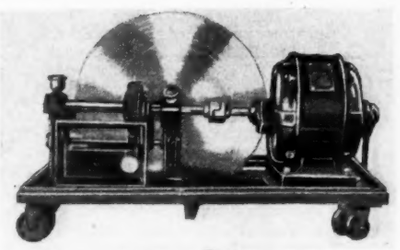
for lifting the piston when the suction is sufficient is admitted through the ball valve seen at the bottom of the piston chamber on the left. To adjust the nozzle the jet can be raised or lowered by means of the finger nut at the bottom of the carbureter, there is a hot air muffle and also a starting choke throttle in the air pipe. It may be noticed that the float chamber and air pipe are clamped to the central portion of the carbureter by a split ring, so the flange can be turned into any position that suits the manifold. Complete with hot air stove, flexible pipe, etc., the price is $12.50.—Frost Mfg. Co., Kenosha, Wis.

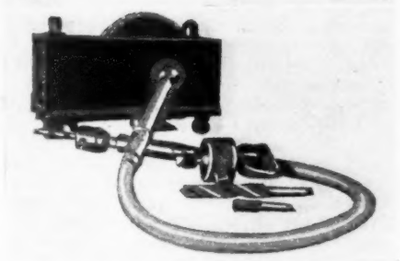
Goodrich Tire Caliper

An ingenious instrument for gauging the degree of inflation of a tire is the special caliper manufactured by the B. F. Goodrich Co. The operation of the



Goodrich caliper for gauging degree of tire inflation

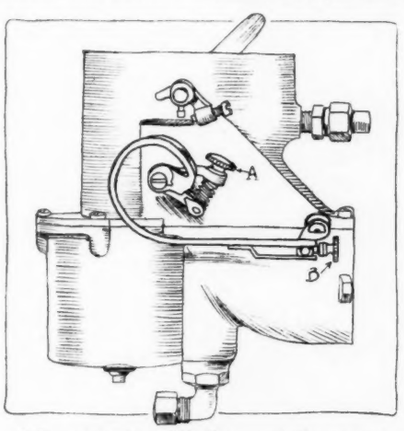




Peerless portable electric power outfit

caliper is based on the fact that the amount of bulge in the side walls of a tire, at the point where the tire rests on the ground, bears a definite proportion to the diameter of the tire at the top where there is no weight to cause bulging.

The caliper, which is of nickeled steel, consists of a bar with a leg projecting at right angles at one end of it and a second leg, parallel with the first, sliding on the bar. On the bar are two scales, one above the other, marked with



J-B carbureter with thermostatic control

letters. The lower scale begins at a point further from the stationary leg than the upper scale. In other words, A on the upper scale is nearer the stationary leg than A on the lower scale. The difference between the two A's is the proper difference between the diameter of the tire at the top and the bottom.

To use the caliper it is first adjusted to the tire at the top, the sliding leg being moved until the tire just fits between the legs. The mark of the top scale is then noted and the sliding leg moved until it stands the corresponding mark on the lower scale. The caliper is straddled over the tire and rim at the bottom, where the tire is bulged from the weight of the car; if the bulge is just sufficient to fit snugly between the caliper legs the inflation is perfect. If the caliper is loose on the tire the tire is too hard and air should be let out until the space is filled, while if the bulge is so great that the caliper will not go down, air should be pumped in until the proper diameter is produced. The device is intended for use with any make and type of pneumatic tire. Both legs fold on the main bar and the whole tool goes into a leather case 10 1-2 inches long. The price is $1.—B. F. Goodrich Co., Akron, O.

Portable Power

In a repair shop, in a large stockroom and in many other places it is useful to be able to tap a source of mechanical power and electricity has made it possible to take the tool to the work instead of moving the work to the tool. In repairing it may easily save many dollars if it is possible to drill a hole without pulling down anything, but the average garage man can hardly make it pay to equip with a great variety of pneumatic or electric hand tools.

To overcome this difficulty the "Peerless" outfit has been produced. It comprises an electric motor mounted on a wheeled stand, and provided with a friction driving gear so that a flexible shaft can be set to revolve at any required speed. There is an adjustment for the friction gear to take up wear and to vary the degree of contact, while the gear allows the tool to be stopped without switching off the motor. Several sizes are made from 1-4-horsepower up to one horsepower, and the latter size will operate a 1 1-2-inch drill. Six speeds of tool shaft are given by the gear, and attachments will increase this range to eighteen speeds. The motor is a Westinghouse, and is supplied for either direct or alternating current.—United Mfg. Co., Kansas City, Mo.

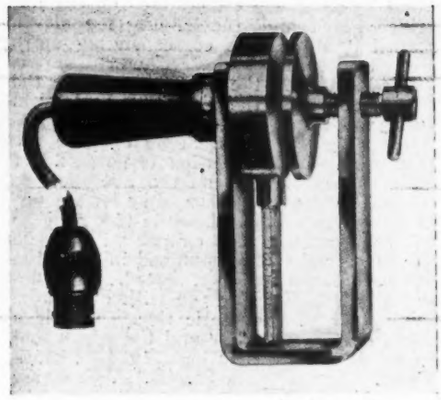
Ford Shock Absorber

This is a new design of supplementary spring which has as its main feature an adjusting cap so that it can be set to suit runabouts, touring models or delivery wagons. The absorbers are double acting and can be fitted to both the front and rear springs.—Oxygen Generator Co., Troy, N. Y.

Thermostatic Control Carbureter

The idea of fitting a carbureter with an automatic control to adjust the mixture to suit temperature variations is a popular one and the J-B system seems to be about the extreme of simplicity. The carbureter is a simple pattern having a plain jet in the mouth of which there hangs a metering needle. This is suspended from a lever on the inner end of the shaft to which the thermostat is attached; the latter causes the shaft to twist as it expands or contracts, and so lowers the needle further into the jet, or lifts it out.

In the illustration A is the inner end of the thermostat and the screw sets the position of the metering needle when the motor is normally cold—when it is at a temperature of about 60 degrees say. The screw B limits the degree to which the thermostat can lower the needle and is thus the high speed adjustment.



Corbett & De Coursey small electric vulcanizer

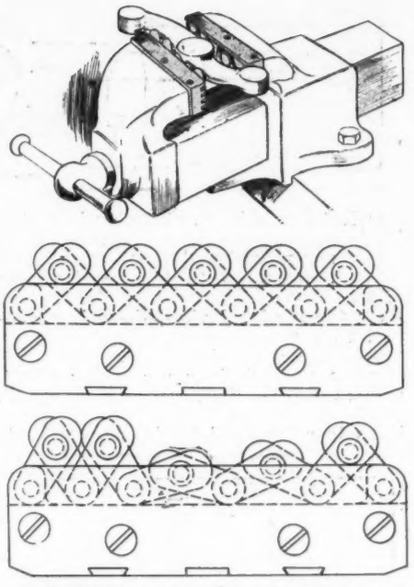
There is an air valve with an independent control, so the carbureter works much like the usual kind, but with the difference that a hot motor automatically gets a leaner mixture than a cold one.—J-B Carbureter Co., Los Angeles, Cal.

Small Electric Vulcanizer

The thing which keeps most motorists from doing their own repairs to punctured air tubes, is the trouble of the process, but the electric type of vulcanizer certainly helps to minimize this. One of the simplest, lightest and smallest machines is the Corbett & De Coursey which works off any six volt storage battery and so allows repairs to be made on the road. It should be quite easy to vulcanize a tube while running the car, as the vulcanizer is so light that it could be held by any passenger without fatigue. With the machine is a thermometer which allows the temperature to be controlled, and also a length of flexible wire furnished with a socket to fit the usual inspection lamp holder on the dashboard. It sells for $5 and needs no extras except vulcanizing compound.—Corbett & De Coursey Co., Pittsburgh, Pa.

Self-Adjusting Vise

Every mechanic knows the inconvenience of the ordinary vise when it is desired to hold some piece that is awkwardly shaped, and the illustrations show a very ingenious way of getting over the trouble. This is the invention of G. E. Storey, an English tool maker, and the idea is to make the jaw of the vise accommodate itself to the shape of the thing to be gripped. To give this quality the usual jaw is done away with and replaced by a short length of chain, fixed at both ends, but with the individual links free. Normally the links stand at right angles and offer a straight surface, but if they are pressed on an uneven object they will slide until they wedge against the object and each other. The action is made quite clear by the drawings and it appears to be a simple notion that may have far-reaching effect. If the vise acts as efficiently as it apparently ought to do, it should find world-wide application.—C. D. Burton Griffiths & Co., London, England.



Self-adjusting vise jaws. Above they are shown mounted on a bench vise. In the center with the members in normal position and at the bottom with members disposed to fit an object of irregular shape

Catalogue and Pamphlet Review

Electric Horn Fittings—The Benjamin is a special horn-button made with a large, rounded top, and pressure on any part thereof makes the cotnact. The button does not have to be felt for and can be clipped on the steering wheel or attached to the body. The maker of this button also manufactures a variety of complete horns at prices varying from $4 upward. The special button alone costs 60 cents.—Benjamin Electric Mfg. Co., New York City.

Electric Horn—The Newtone horns are well known as examples of sound electrical types, but a recent circular draws attention to a cheap pattern selling for $3.50 called the "Apollo." This is a vibrator horn, while other Newtones are of the motor-operated sort. — Automobile Supply Mfg. Co., Brooklyn, N. Y.

Electro-Mechanical Horn—The Garford is a motor-operated electric warning signal with a special style of cam which is claimed to give it unusual durability. The makers state that their method of arranging the striking mechanism which vibrates the diaphragm is such that the bearings of the shaft that carries the little cam are subjected to much less stress than usual. Another feature is an easily removable rear-end cover which allows the owner to take off the protecting cap and so oil the mechanism without disturbing any electrical connections.—Garford Mfg. Co., Elyria, O.

Goggles—A new pattern of goggle is the Zylbox, which has a light frame of imitation tortoise shell and a self-adjusting nose bridge of four-ply silk. It is claimed that this soft material rests gently against the wearer and cannot possibly chafe or irritate. This special construction is said to allow the goggles to fit closely on any face, so closing every crack through which dust could possibly find its way to the eyes of the wearer.—T. A. Wilson & Co., Reading, Pa.

Kerosene Carbureter Tests — Recent tests of a W. G. kerosene carbureter are described in a small book issued by the makers. These comprise tests made on a Fiat, a Ford and a Chevrolet car and also on one of the Fifth avenue buses. The tests all showed good economy and good action generally.—W. G. Kerosene Carbureter, New York City.

Kick-Switch Lock—This switch is designed to fit on a Ford metal coil box in place of the original one and in appearance is simply an ordinary kick switch. With it is incorporated a Yale lock, however, and it is necessary to turn the key to obtain either the "on" or "off" positions. This gives considerable security to the owner, who thus finds the advantages of a kick switch and a lock combined in one article.—New York Coil Co., New York City.

Garage Jacks and Presses — Good-wheeled jacks for moving a car by lifting the whole axle are almost essential garage equipment. The Weaver garage jacks are made in several sizes and patterns to suit different classes of service, and there is also a two-wheeled jack with a long lifting handle, called the "auto ambulance," for crippled cars. The same manufacturers turn out other articles of value to the repairer, including small hand presses and drill chucks.—Weaver Mfg. Co., Springfield, Ill.

Inexpensive Portable Garage—The Kolb company make all sorts of portable buildings and specialize on inexpensive garages for private use. One of these sells for as little as $85, and measures 10 feet by 14 feet. This is, of course, a small size, but the upward range embraces all dimensions. — Kolb Portable Building Co., New York City.

Tire Pumps and Oil Guns—Despite the growing use of compressed-air lines and engine-driven tire pumps there is still a large demand for good hand inflators of the accepted and time-tried kind. Bridgeport pumps are in this class, and are made in single-action style of compound two stage. Special features are the method of attaching the pump cylinder to the foot and the use of the best class of material. The oil guns made by the same firm are of accepted pattern, well finished, and with good, large handles.—Bridgeport Brass Co., Bridgeport, Conn.

Ford Honeycomb Radiator—A special hood of taper form adds perhaps a good deal to the appearance of an old Ford, and this is still more greatly enhanced by a V-shaped honeycomb radiator. The radiator also gives greatly more cooling surface than the standard kind, which is an advantage of real practical value. A very smart hood and a well-made radiator known as the "Superior" are supplied for $52.65, or the hood alone for $11.40, while $8 is allowed for the old Ford radiator regardless of its condition.—Superior Lamp Mfg. Co., New York City.

Care of Electrical Equipment—Of the several periodicals which we receive from manufacturers dealing with their products in a magazine style there is none more interesting than the Delco. This contains various stories not closely connected with electric starters and generators, but it also has hints on the easy and simple upkeep of Delco outfits in particular and electrical machines in general. These hints are expressed in language free from technicality and should be appreciated by the average user.—Dayton Engineering Laboratories Co., Dayton, O.